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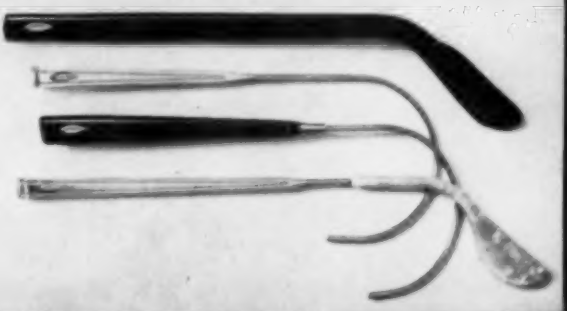

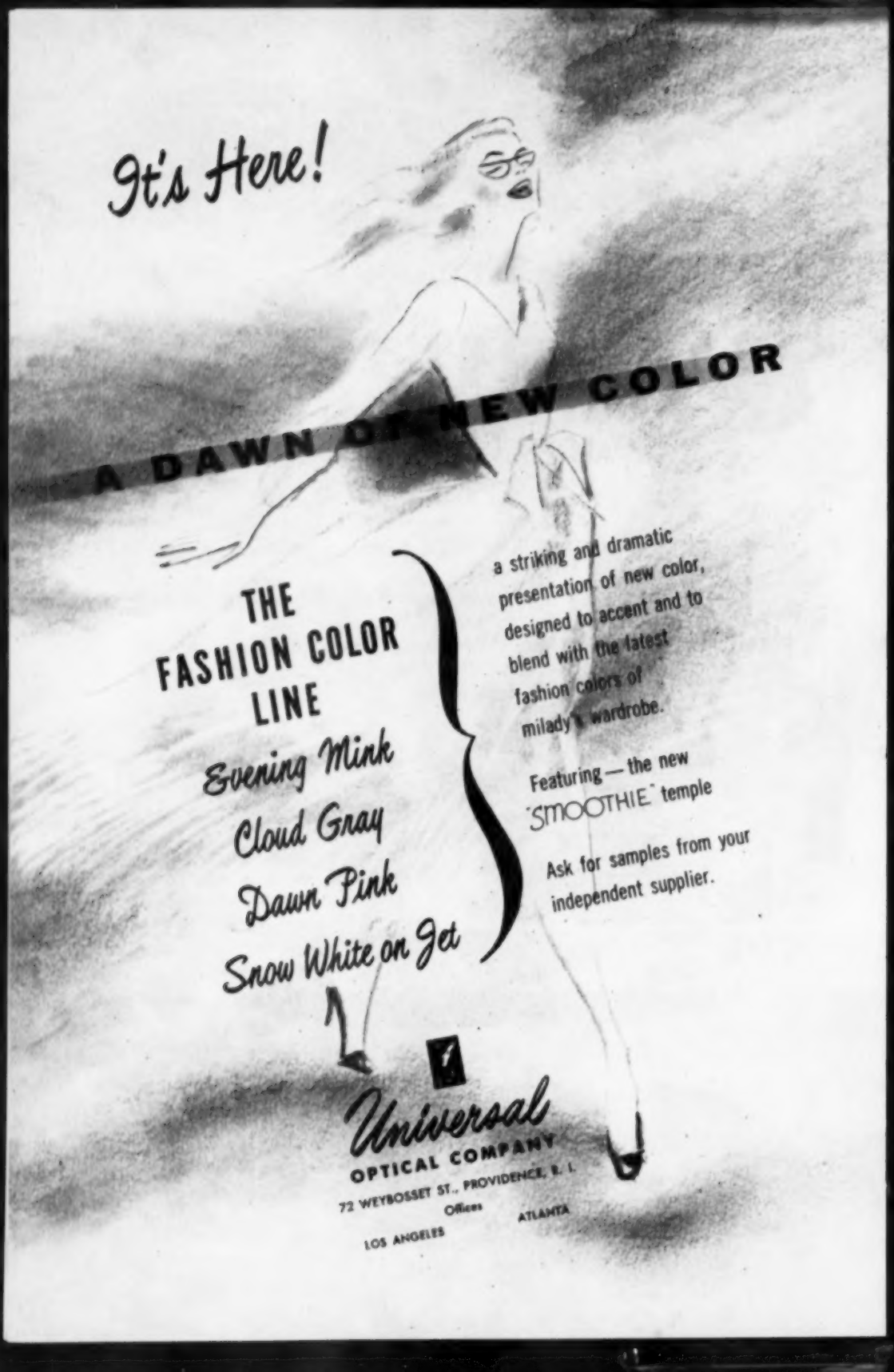
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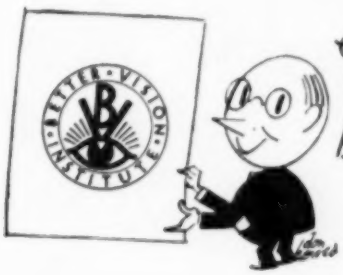

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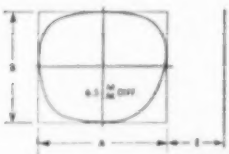

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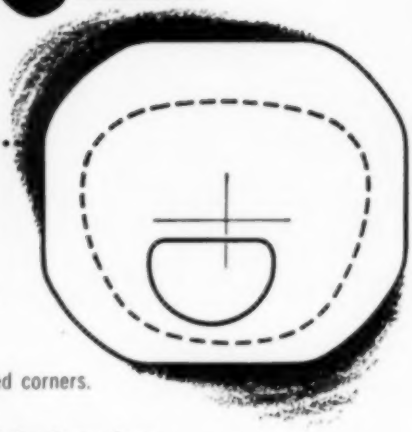

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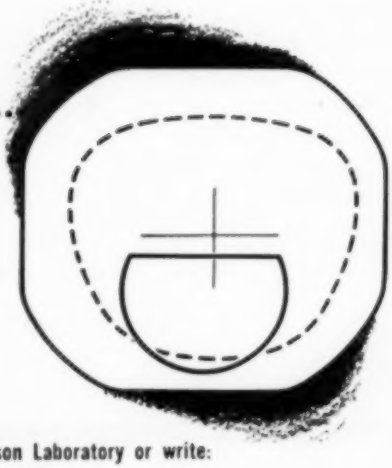

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SOME PROBLEMS OF BINOCULAR VISION*

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Chicago College of Optometry
Chicago, Illinois

The progress of visual science might be measured by the extent to which physico-physiologic mechanisms have gradually come to replace descriptive phrases and words as explanations of observed phenomena. "Explanation" however is a relative term. If a five-year-old were to ask us why day follows night we might "explain" to him that the sun rises in the morning and sets in the evening. This, and similar ingenious explanations offered to children, would be considered absurd by an astronomer or theoretical physicist.[1] Nevertheless, the "explanations" of the earth's rotation devised by astronomers of a hundred years ago are, in the light of modern knowledge, just as absurd. Our current conception of things and events are, it is to be hoped, closer to the "real" truth. On the other hand, no one who has given the matter any thought would be foolish enough to believe that we have arrived at absolute truths concerning anything.[2] Such things as absolute truths and ultimate reality (and whether we can ever achieve them) had better be left to the philosophers. For our purposes, an explanation is "better" when it takes into consideration a greater number of experimental observations and, more important, when it has a higher proba-

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[1]All of which does not in the least detract from the explanation as far as our five-year old is concerned. It is therefore a *useful fiction* and, according to Hans Vaihinger, such fictions play a dominant role as the basis for all knowledge (of children or scientists). The philosophy of "As If" as it is called, is founded on such useful fictions. For example, Vaihinger writes: "What we call a *natural law* is a fiction. It is nothing but an expression for the totality of relations existing in a group of phenomena. It is a summational fiction. If by *law* we intend anything more than the regular sequence of events of which it is a summary, if we intend any 'force' or 'power' which determines the sequence, we are misleading ourselves by a typical fiction, comparable to abstractions and generalizations."

[2]Strangely enough, as Heisenberg has shown, if anything is certain it is uncertainty. But we need not lose any sleep over the matter. As it happens, despite the principle of indeterminacy, our formulations are based on probabilities which involve such tremendous numbers that the strongest reliance may be placed upon them.

bility of predicting the outcome of other (future) experiments or clinical procedures.

It may perhaps be useful to set the limits of the present discussion at the outset. When a sense organ such as the eye is stimulated by light, we can evaluate the radiation by appropriate measuring instruments. We could then state that it had such and such an intensity, extensity, wavelength composition, saturation, duration, etc. But we could go further. By attaching electrodes to the optic nerve fibers we might analyze the stimulus to the occipital receiving area. Different measuring devices would, of course, be necessary for we are dealing with a different manifestation of energy. Our next step might be the analysis of the cortical events themselves—particularly those which occur in the visual cortex. If our instruments were adequate, we might possibly observe that there is an activity peak which is shunted about to other areas of the cerebrum and central nervous system—that it is transmitted to specific muscle groups and that the eye (or head or body) executes a definite movement. In carrying out such a task, we have used physical instruments because we have measured physical (optical, chemical or electrical) events. This is as far as physiology can go at present.

We have said nothing about the sensory (or perceptual) responses which may occur along with the physical events. Physical instruments cannot be used to measure a sensory phenomenon, nor can they be made to yield data concerning its intensity, extensity, hue, duration or affect. In short, there is no physical device which will enable me to determine what you see. I could, of course, measure certain motor responses by means of instruments but this would tell me nothing concerning your visual experience. It would only reveal certain concomitant (or resultant) physical manifestations of your experience and we are right back where we started.[3]

Are we then no better off? A more serious look at the problem reveals that our analysis of the cortical stimulus does lead to some positive results. For one thing, we might be enabled to relate a definite motor response to a definite cortical event. We do not have to become behaviorists to appreciate the potential clinical significance of this. Accommodation, convergence, versions and phorias are motor phenomena. Also, it is becoming increasingly evident that strabismus is a motor problem and to know the mechanisms involved in the control of

[3]There are some who maintain that such measureable motor (or behavioral) events are all that there is to investigate. They may be right. On the other hand, my enjoyment of a Beethoven symphony is not diminished by the absence of any overt motor or verbal response.

ocular movements may be expected to bring us closer to the prevention and control of this anomaly.

As regards the sensory aspects of the response, other means must be devised to evaluate them. For example, while measuring the electrical changes in your occipital cortex, I might have you describe, compare, discriminate, evaluate, that is subjectively analyze your visual experience with respect to color, brightness, direction, distance, size, shape, etc. If my recording instruments were sensitive enough, and if your description were precise enough, it might be possible for me to predict (after some trials) the nature of your sensory experience from my instrumental readings alone. Such data would make possible a correlation between a measurable physical event (in your brain) and your subjective analysis of the sensorial response. We could then state that when a particular configuration of radiant energy strikes the retina, a corresponding (isomorphic if not duplicate) configuration of electrical energy arrives at the visual cortex and there sets off a particular configuration of activity which is in turn accompanied by definite sensory and/or motor responses. Knowing this, it would not be too much of a jump to change the retinal or cortical (electrical) events and produce predictable concomitant sensorial and motor changes as well. And this, in any event, is all we could desire from a clinical point of view.

One must hasten to add that no such precise analysis of the cortical events is possible as yet. The available instruments and techniques are still too crude to allow us to observe much more than a jumble of nerve impulses (with some recognizable patterns).[4] We are not even certain, although we have some fairly good ideas, as to how a particular configuration of radiant energy in the eyes sets off a specific pattern of impulses in the optic nerve. Whether this goal can ever be achieved is questionable but it indicates the direction of the physiologist's interest at present.

The anatomists have done considerably better. We now have a fairly complete picture of the nerve pathways between retina and cortex.[5] And, if we do not know what the "messages" are, at least it helps to understand where the wires come from and how they end. You may not be able to hear my telephone conversation but you can be pretty

[4]The most comprehensive summary of such work with human material can be found in "The Cerebral Cortex of Man" (1950, MacMillan) in which two neurosurgeons, Penfield and Rasmussen, describe their 19 years' experience with focal epilepsy.

[5]Excellent summaries of this area of knowledge can be found in (a) Hines, M., 1942, "Recent contributions to localization of vision in the central nervous system," *Arch. Ophth.* 28:913; (b) LeGros Clark, W. E., 1942, "The visual centres of the brain and their connexions," *Physiol. Rev.* 22:205, and (c) Walls, G. L., 1952, "The problem of visual direction: II. The tangible basis for nativism," *Am. J. Optom. and Arch. Amer. Acad. Optom.* 28:115.

confident that I am not talking to anyone in London if you see the operator plug in the New York line. Anatomy thus provides us not only with certain positive clues but enables one to rule out quite a number of impossible mechanisms.

Now let us imagine for a moment, that such a refined recording apparatus did exist and that it were possible to measure and analyze the cortical event with high precision. What would such an analysis reveal? Certainly we could not expect the electrical activity of the brain to resemble the concomitant sensorial event. The stimulus-response relation may be assumed to occur in a space-time sequence and thus to be isomorphic. But such an isomorphism holds only if the objective and sensory space-time continua are themselves related. Various attempts have been made, since the time of Fechner, to express such relations in mathematical terms. The acceptance of such expressions depends upon the metaphysical assumption of a fundamental unity between objective and subjective events. It would seem that recent work by Ames, Ogle, Luneburg, Fry and others makes such a philosophic assumption inevitable. On the other hand, when we step outside the realm of metaphysics and into the laboratory, the methodologic approaches to physical and sensory phenomena remain as widely separated as ever they were.[6] We must therefore remain content with two separate types of investigation, each utilizing its own fairly exact methods and techniques, the results of which may or may not be related by more than logical considerations.

With these limitations clearly in mind, I have selected a few examples of phenomena in the field of binocular vision in which the lack of distinction between objective and sensory events has created pseudo-problems. In order to confine the discussion to a single paper, the description is somewhat abbreviated and simplified. The examples do not constitute complete stories in themselves but are here used to illustrate that a physiologic approach to such problems is not only possible but quite fruitful as well.

THE PROBLEM OF SENSORY FUSION

Like the construction of perpetual motion machines, this problem

[6]The lack of identity between stimulus and response cannot be emphasized enough. For example, we believe that the frequency of nerve impulses (objective event) is related to perceived brightness (subjective event). Similarly, wavelength of radiant energy is related to perceived hue. There is obviously little similarity between such events—they belong to different methodologic categories. It would not therefore be reasonable to assume, as many have done, that perceived space and physical or objective space are any more identical. Each requires its own method of investigation just as we would not use the same instrument for measuring heat or the passage of an electric current. Whether the objective-sensory duality will ever resolve itself as electricity-heat into two manifestations of the same thing, i.e., energy, no one can yet predict.

seems to be of ever recurring interest. The problem arises as the result of the fact that we have two eyes each of which receive its own, slightly different, view of external objects. Each eye transmits, to the visual cortex, the nerve messages elicited by its retinal image. Nevertheless, we perceive a single visual object. Two questions arise. (A) In what manner is the double stimulation of the cortex resolved into a unitary (perceptual) response? (B) How does this unification accomplish the perception of (binocular) tridimensionality?

To "explain" such unification as the result of "psychologic" (or even "psychic") processes is obviously to evade the issue since our knowledge of such processes amounts to little more than pure guess work.[7] Recent anatomic and neurophysiologic data makes it possible to obtain at least a rough picture of the underlying (physical) events. For example, the known distribution of optic nerve fibers within the nerve, chiasma and tract, the absence of internuncial neurons at the geniculate relay[8] and the final precise endings in the striate cortex all point to an anatomic isomorphism of amazing exactitude. In a recent paper, Walls[9] has summarized the extensive literature which establishes this beyond any reasonable doubt.

The functional significance of such neuro-anatomic precision becomes obvious when one considers that it provides for the excitation of a single discrete cortical event even though two (corresponding) retinal events occur. Thus, Le Gros Clark[10] writes: "Hence, if (as seems certain) the impulses from corresponding points in the two retinae remain distinct within the limits of the geniculate body, they must be

[7]The notion that fusion is a "mental" process is fairly old. It appears that Kepler (1611) was the first one to advance such a view, followed by Porterfield (1759), and many others since. In this connection consider Duke-Elder's statement: "Were the anatomical convergence of the two paths to connote a common mechanism situated at their junction, the rational result of such a physiological union would be an algebraic summation or interference of the two sets of impressions. On the contrary, we find that two complete and independent sensations are elaborated independently, and that these are subsequently subjected to psychical union at a higher level, where there is created out of them a percept of completely different attributes." One also finds in the orthoptic literature such statements as "One must know how the squinter is organized because it may be necessary to change his mental pattern. The eye will not be straight until the neural organization is changed" and "The mental organization of the normal and anomalous projector is not the same." (Murroughs and Shepherd—*Optom. Wkly.*, Sept. 14, 1950.)

[8]The anatomic isolation of fiber paths in the geniculate body does not preclude the possibility of neuro-physiologic interaction. Such interaction has recently been reported by Bishop and Davis. (*Science*, Aug. 28, 1953, 118:241.)

[9]Walls, G. "The Problem of Visual Direction," 1951, *Am. J. Optom. and Arch. Amer. Acad. Optom.* 28: Nos. 2, 3, 4.

[10]Le Gros Clark, W. E., "The Visual Centres of the Brain and Their Connexions," *Physiol. Rev.* (July), 1942.

brought into the most intimate relation as soon as they are projected on to the cortex, and it may be inferred that the cortical mechanism for the fusion of two images necessary for stereoscopic vision is very localized spatially." The Scandinavian neuroanatomist Henschen had already come to similar conclusions some 25 years ago.[11] It appears therefore, that cortical cells (within limits) act in a similar manner to typical anterior horn cells of the spinal cord, that is, as a *final common path*. (Figure 1.)

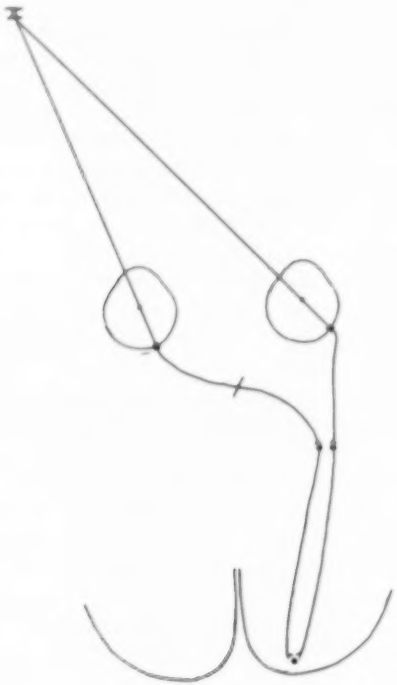

Figure I

[11]In fact, Galen was probably the first one to suggest such an approach, and he lived some 1,800 years ago. The notion of fixed neuro-anatomic correspondence, that is the neural projection of two corresponding retinal points onto a single cortical cell, was clearly implied by Johannes Müller in his "Physiologie des Gesischtssinnes" of 1826. (The same Müller, incidentally, who formulated the doctrine of specific nerve

It would follow from the above that, although there are two ocular events, these correspond to a single unitary cortical event. The anatomic evidence points to an almost point for point projection. Whether this precision extends so far that only one single cortical cell is stimulated (by two corresponding retinal ganglion cells) must still remain an open question. It is not a problem of anatomy but of neurophysiology and, as I have pointed out, our methods are still too crude to allow us to establish this.[12] There is in fact, some evidence which would indicate the contrary but this evidence is sensory not physical. Thus we can show that binocular brightness is not greater than monocular[13] or that the binocular threshold is no lower than the monocular (by an amount which could not be accounted for on statistical chances of the threshold number of light quanta reaching two, instead of one receptive surface).

Such reasoning is, of course, dangerous. That the stimulus must resemble the response in its spatial configuration is only an assumption. The fact that a unitary perceptual response occurs with a non-unitary cortical cell stimulus or event is definitely not out of the realm of possibility—even though the neuro-anatomic evidence does indicate a remarkable spatial isomorphism. For example, recent neurophysiologic studies suggest that neuron circuits, rather than individual cells, become activated. One might imagine that the operation of a binocularly excited circuit differs in some (though minor) respects from one which is brought into action by one eye alone.[14] Such a difference *would not*

---

energies.) The theory began to be questioned when Panum, 32 years later, showed that single vision may occur with *slightly* disparate, i.e., non-corresponding retinal stimulation. This *subjective* observation does not *prove* a neuro-anatomic cortical duality for the so-called retinal Panum's areas may be nothing more than an expression of the length of the dendritic ramifications of *individual* cortical cells coupled with the monocular neural convergence of several photoreceptors to one ganglion cell *within* the retina. An objection which is more to the point is the possibility of "enlarging" Panum's areas through training (e.g., Volkmann, 1859; Miles, 1949, and Walls, 1952). If such a possibility is realized, a concept more in line with my suggestion of cortical neuron circuits is implied.

[12]Although there is little doubt of such a re-enforcement as far as the efferent (motor) outflow is concerned.

[13]Fechner in 1860 pointed out that a bright surface regarded with two eyes looks no brighter than when observed monocularly. Sherrington in 1904 thought that he had settled the matter with his flicker experiments. DeSilva and Bartley (1930) and Fry and Bartley (1933) believed that they had demonstrated binocular brightness summation. Walls (1948) criticized the experiments and concluded that such summation did not exist. Fry and Bartley (1950) refuted Walls' criticism. Crawford (1939) and later Pirenne (1943) showed that the binocular intensity threshold was lower than the monocular but by an amount that could be statistically accounted for. Lythgoe and Phillips (1938) found binocular summation in dark adaptation and so on and so on. Obviously quite a number of people will disagree with my generalization.

[14]In his rather thorough analysis of binocular versus monocular vision, Walls (1948) concludes that a real difference exists only as far as color fusion is concerned.

necessarily involve summation of impulses. If the two monocular "messages" which reach the cortex simultaneously differ somewhat from each other, one might imagine that a greater than monocularly elicited gradient of activity results within the same or neighboring circuits. This gradient would be the added binocular stimulus for the tridimensionality of the percept.[15] It would be a gradient produced by monocular stimulus correlates *reenforced* by binocular disparation. Be this as it may, we cannot yet come to definite conclusions as to the mechanics of individual cortical cell activity. When I speak therefore of a single cortical event,

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The differences therefore are minor indeed. It should be pointed out, however, that this implies that the kind of neural "gradient" to which I refer, and which is assumed to be the cortical stimulus for tridimensionality, can also be produced by monocular retinal stimulation. The thesis that correspondence has its neural counterpart in terms of physiologically (not anatomically) predetermined pathways effected by synaptic thresholds has been advanced by Burian. Under certain conditions, as in concomitant squint, it is postulated that a change occurs in the synaptic thresholds thus redirecting the flow of impulses. This conception was later applied by Burian and Capobianco (1952) to explain post-operative monocular diplopia.

[15]Linksz (1952) gives a didactically very satisfactory picture of what such a gradient might actually be like for the binocular seeing of retinal disparate targets. I have reproduced his argument verbatim below. One objection to such a scheme, in the present context, should be pointed out, however. The 5th (a) assumption clearly implies that monocular stimulation results in an excitation confined to the Gennari stripe and will therefore lead to a bidimensional perceptual response. This means that we are left with no neural basis for monocular tridimensionality or, we would have to believe that monocular and binocular tridimensionality are fundamentally different. I cannot see how such a belief would be tenable, particularly, since the so-called monocular "cues" for depth are strict stimulus correlates (as pointed out by Gibson, 1950) and not "partial sensations" which must somehow be integrated. At any rate, Linksz makes the following assumptions and since his scheme is only didactic, the objection is not too serious.

"1. Connections from each retina retain their individuality throughout the optic radiation.

2. Volleys discharged by excitation of retinal 'points' (elements) travel in straight lines through the depth of the cyclopean cortical retina.

3. Volleys discharged by similar excitations of the two retinas (that is, 'corresponding' volleys of excitations) attract each other and have a tendency to merge (to 'fuse'), as soon as they can, *along their straight respective paths* within the cyclopean cortical retina.

4. A conscious visual experience, *as a neural (cortical) event*, is confined temporally and spatially.

5. A volley discharged by excitation of a particular retinal 'point' (element) can 'go off,' can be consummated into such a 'conscious' event at a number of 'points' along the path of the volley (which is a straight one) throughout the whole depth of the cyclopean cortical retina.

(a) In case of monocular stimulation the excitation 'goes off' (the conscious event takes place) the moment the volley of excitation passes the stripe of Gennari and within the Meynert cells of the latter.

(b) In case of simultaneous binocular stimulation the 'corresponding' excitation 'goes off' (the conscious event takes place) at that moment and at that point of the cyclopean cortical retina at which 'corresponding' volleys of excitation have the first chance to fuse. If need be, they even pass Gennari's layer.

6. 'Corresponding' elements are such elements of the two retinas the respective cortical connections of which meet in the stripe of Gennari."

it does not rule out the possibility that this event is a complex one which may involve one or more neuron circuits.

A discussion of how this gradient produces this particular sensorial event would be as futile as an attempt to discuss how wavelength produces color or the physical indentation of the skin produces a sensation of touch. All we can do is relate or correlate a given sensory event with a given stimulus.[16] But this should not deter us from analyzing the stimulus with more and more precision in order to increase the probability of our correlation. If we could carry through an experimental program such as outlined here, then we could say that when a particular sequence of events occurs in the cortex, we will have a unitary (either bi- or tridimensional) percept. If another sequence of cortical events occur, we will have two (either bi- or tridimensional) percepts. (Which may be one percept in two different directions.) But that is as far as we can go. To postulate a special mechanism (such as some sort of genie for example) which somehow puts two sensory events together is to disregard that the two perceptual possibilities are mutually exclusive. If anything *had* to be put together, it would not be two sensory but two *physical* events.

There is one objection to simple neuro-anatomic fusion schemes which is almost always raised even by those who should know better. It runs something like this: Are there not two cerebral hemispheres, distinctly separated by a longitudinal fissure and does not the monocular retinal "image" become split between them? Granted that cortical "half-images" unite to produce a single cortical event, how are the two unified "half-images" (one in each hemisphere) integrated—particularly when there is no anatomic evidence (in man) for commisural fibers between the two striate areas? This argument is illustrated by Figure 2.

This objection can easily be removed. Possibly, its very obviousness may have been deceptive. All we need do is remember that physical (bodily) events need not be a stimulus for sensory responses. Assume for example that all sensory and motor fibers to the left hand were cut.

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[16]In this connection Koffka in his "Principles of Gestalt Psychology" (1935, Harcourt Brace Co.) writes as follows: "For the physiological processes which we construct as the correlates of consciousness are known to us in the first place through their conscious aspect. To treat them as though they were purely physiological, without this conscious aspect, would be to neglect one of their outstanding characteristics. True enough, this conscious side of the processes does not enter into our causal explanations, but it has to be recognized as a fact nevertheless. And that leads to the conclusion that it is of the ways and wool of certain events in nature that they 'reveal themselves,' that they are accompanied by consciousness. Why they are so, and what special characteristics a process must have in order to be so, these are questions that cannot now be answered, and perhaps may never be."

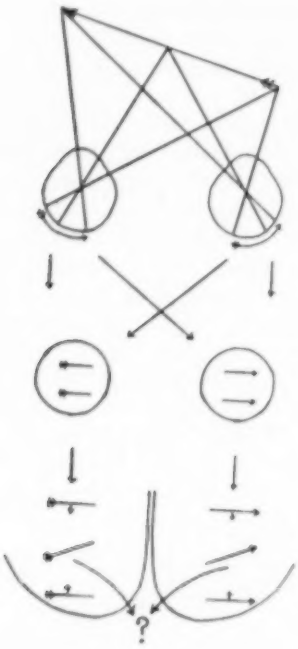

Figure II

The hand, as such, no longer has a sensory existence (providing we don't look at it). It is no longer a part of our "felt" body although it continues to have *physical* existence.

The reverse situation obtains if we were to amputate the hand. The patient *feels* a hand where none (physically) exists. One wonders if the proponents of the "visual projection" theory would now postulate a special sense whereby this physically imaginary (but sensorially real) hand is "projected" into space!

The physical body obviously contains structures and organs which do not normally send suprathreshold impulses to the higher "conscious" areas of the brain. The intestines belong in this group. As far as our usual sensory experience of them is concerned the abdomen might just as well be empty. Other parts of the physical body simply do not have any neural representation at all. These can *never* have sensory existence. We can never become aware of the optic disc as a

perceptual event. A frequent but foolish reason given for this is that the two optic discs do not overlap in the binocular field. One only has to close one eye to note that it does not appear (as a hole or dark or black area) in the monocular field either.[17]

We can demonstrate the physical existence of the optic disc by looking at someone else's eye. We can demonstrate its functional consequence (i.e., blindness) only by *inference*. We may note that an object previously seen (and whose physical existence we assume from other sense data) disappears when its reflected light falls on this particular region of the retina.

What has been said concerning the optic disc also applies to the cerebral longitudinal fissure. There are no receptors in empty (it seems almost silly to say physical) space. We *sense* the presence of the fissure as much as we *sense* the space between our legs (although, at least, we can *see* the latter).

Now if the space between the occipital lobes has no possible sensory existence, it cannot very well separate two sensory events. It can only separate two physical events— and so it does, but what of it? The spatial configuration of the stimulus need be only a correlate not a copy of the sensorial (perceptual) response! The perceptual response is a continuum as little interrupted by the longitudinal fissure as by the optic disc.

This is the reason why there is no vertical "seam" or "blind spot" in our *monocular* visual field.[18] This is why no commissural interhemispheric fibers are needed and why, in the long history of human malfunction, no one ever had "diplopia" consisting of two unified "half-images."

THE PROBLEM OF PROJECTION

We now will consider a problem which consistently arises in discussions of binocular vision (although it is actually a monocular problem). Of all the fruitless and senseless arguments this one has probably consumed more time than any other. The question usually comes up like this: "Why do we see a visual percept out in space, outside ourselves, when the excitatory event occurs in our eye (or brain)?" Again the problem arises from a failure to distinguish between physical and

[17]It should be pointed out, however, that von Tschermak-Seysenegg claims that the optic disc may be visible entoptically when one eye is opened after light has been excluded for some time. I have not been able to confirm this observation. Apparently neither has Bartley (1941) who discussed the matter at considerable length.

[18]See e.g. Walls, G. L., "Is Vision Ever Binocular?" 1948. *Opt. J. and Rev. Optom.* (August 15) 85:33.

perceptual events. Here, however, the misunderstanding is even more fundamental.

There are really two questions being asked and it is essential to distinguish between them. The first one deals with the spatiality of the perceptual event—its direction, size, shape, etc. The second deals with the perceived spatiality "outside ourselves." Thus, in the case of the "non-telaesthetic" sense modalities (such as pain for example), the first question applies but not the second.

If a perceptual event is assumed to be projected out into space, then two implications are clear. First, the perception must be initially non-spatial (a ridiculous consequence) and second, the space into which we do the projecting must have existed prior to the event (a self contradiction). The second implication does not hold even if we assumed that physical space does exist apart from ourselves since it is not physical but subjective space "into" which we would presumably project. In the year 1781 the philosopher Immanuel Kant gave us the answers to these perplexing questions in his book "The Critique of Pure Reason." What Kant established once and for all was that all of our experiences are spatial. So convinced was he of this that he believed "space" to be a property of the mind, a form of perception rather than a thing perceived. But one does not have to believe in the philosophical implications of transcendentalism to appreciate that, whatever the reason, all experiences, all percepts, are spatial and, if physical events can exist apart from ourselves, they too must all be spatial.

Now the spatiality—the size, direction, shape of the experience—is *ipso-facto* a property not only of vision, hearing and smell but touch and pain and kinesthesis as well. "Things" whether they be objective or sensorial, can exist only by virtue of this spatiality. A Euclidean "point" may be a useful fiction but it is a concept not a percept.

The "outsidedness" of the spatial experience from myself can now receive a more careful analysis. The key word here is "myself." Myself does not mean my body but my *ego*. It is the "I" of the sentence "I feel ill." It may be the kidney which is not functioning satisfactorily but it is "I," not my kidney, which does not feel up to par. The visual percept is as much outside the ego as the pain percept whose stimulus arises in the kidney.[19] The question of outside "myself" does not therefore

[19] "Visual and auditory impressions are thus necessarily located outside of the body when it is regarded as either a somaesthetic or a physical object. Somaesthetic impressions are necessarily located within the physical body, because we conceptually locate it where we somaesthetically perceive it to be. This conception at once disposes of the absurd tenets of the projection theories. These absurdities are due to the fact

have any meaning. When we speak of vision as a distance receptor what we mean is that the visual percept is at a definite distance from my body as I perceive my body. The percept is outside my perceived or "felt" body and both are outside "me."

All physical stimuli or excitations which can produce sensory experiences occur in my physical body. One is the stimulus for the other but obviously they are not identical, nor would we expect them to be. Some sensory events (which are automatically spatial) are experienced in our body. Such is the case when the excitation culminates in that region of the brain where sensations of our body can be aroused. But, for some reason, few people see in a pain of the little finger a problem involving "projection" from the brain to the little finger. They consider it (and quite correctly) as nothing more than an expression of Müller's law of specific nerve energies. The same "projection" would of course occur (at least initially) if there was no physical hand at all—for example if it were amputated at the elbow.

Now for exactly the same reason, when the excitation occurs in a *non-somaesthetic* region of the brain, the sensory event (which is still automatically spatial) must be experienced outside (more correctly, *not within*) my perceived body.

To summarize, vision is a spatial experience because all sensory experiences (in fact all events, whether sensory or physical) are spatial. This is what Kant taught us. Further, this spatial visual experience cannot be perceived as occurring inside our body because the excitation does not occur in the region of the brain where such bodily sensations can be aroused. This is no more than the application of Müller's law.

It thus appears, from an analysis of the problem, that projection as a process must be rejected. The "projectedness" is as much a part of the visual percept as its color or brightness or direction. That such a view is neither original or remarkable but has been arrived at by others who have given the matter due consideration is illustrated by the following interesting quotation from William James[20] *and written in 1890.* (The italics are his):

> *"I conclude, then, that there is no truth in the 'eccentric projection' theory.* It is due to the confused assumption that the bodily processes which cause a sensation must also be its seat.

that the proponents of these theories tacitly adopted a dualistic position, and then proceeded to *forget* that our knowledge of the location of these physical objects is necessarily inferred from that of sense objects." H. A. Carr. (1935. "An Introduction to Space Perception." Longmans, Green and Co.)

[20]James, W., "The Principles of Psychology." 1890. H. Holt and Co. (Reprinted 1950 by Dover Publications, Inc.)

> But sensations have no seat in this sense. They *become* seats for each other, as fast as experience associates them together: but that violates no primitive seat possessed by any one of them. And though our sensations cannot then so analyze and talk of themselves, yet at their very first appearance quite as much as at any later date are they cognizant of all those qualities which we end by extracting and conceiving under the names of *objectivity, exteriority*, and *extent*. It is surely subjectivity and interiority which are the notions *latest* acquired by the human mind."[21]

We may conclude that the "projectedness" of visual (or any other) percepts is inherent in the percept itself and needs no special mechanism or process (psychic or otherwise). While all this may perhaps seem

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[21]The reader may be interested in some more modern examples. Here are a few:

"Looking into the history of theories on space perception, one finds that most authors who accepted the projection theory were at the same time believers in the empiristic origin of space perception. We 'learned,' so they believed, to project visual impressions into space, implying that if we would not have learned it, we would not project them. These scientists obviously thought that the newborn infant does not 'project' from the beginning. And since he does not 'project,' whatever vague visual impressions he might have, he perceives them obviously as being within himself, within his eyes. What absurd consequences of a poor theory!"—A. Linksz (1952).

"For this reason, every theory of projection is doomed to failure, aside from the fact that the assumption of an analogous psychological function for the vision of animals, particularly shortlived animals, would meet with the greatest difficulties. Only the appeal which the theory's close relationship with dioptrics may have can explain why it continues to survive in so many textbooks and especially in popular science."—A. von Tschermak-Seysenegg (1942).

"According to the older so-called projection theory of binocular vision, the visual impressions have no innate spatial quality. The spatial quality is acquired by experience, and the visual impressions are as if projected into space along the objective lines of direction, i.e., the lines connecting a point in space with its image on the retina. Thus a binocularly seen point in space is localized at the intersection of the lines of direction coming from the two eyes. This theory is erroneous, and it would not be mentioned here if it were not for the fact that it can still be found both in textbooks and in scientific papers written by specialists in the field."—H. Burian (1941).

"There is no necessity for the assumption that a person projects his sensations outward from the eyes. All the ingenuity that has been devoted to explaining such an event has been wasted."—J. J. Gibson (1950).

"Every sense in some degree contributes to space perception, for it contributes to the presentation of objects in the outer world. It is true that the simple contact receptor gives knowledge only of an object touching a particular part of the animal's body, and this hardly comes into the category of true space percepts; yet it is the germ of space perception which even in man is egocentric and derived from a knowledge of the body and its parts in space."—J. H. Parsons (1927).

"The fact must be emphasized that the theory of the visual directions is not to be understood as though the retinal images were 'projected outward' from the median imaginary eye along the visual directions instead of from each individual eye along the lines of direction. This opinion, like the projection theory in general, is derived from the false assumption that the retinal images are first presented to the mind and that subsequently one must somehow have transposed them into space. Indeed, most people have no inkling of their existence but are aware only of the sensation in the subjective visual space. The visual directions are only a subsequent intellectual reconstruction of this immediate experience."—F. B. Hoffmann (1925).

self-evident, the term has led to considerable confusion in the literature and in discussions of binocular vision. I suspect that this is due in no small measure to the fact that projection is a verb, clearly implying that it is something which we (or our brain or our eyes) do. This misconception is particularly evident in the orthoptic literature where all kinds of instruments and procedures have been devised to "train" projection. The "logic" of the fallacy is not too difficult to follow. If projection is a process, a function or a mechanism, then of course something may go wrong with it and we have false or anomalous projection. "Obviously" the solution would be to correct and cure the pathology of the projecting process. Since no one has ever discovered any physiologic or anatomic evidence for such a mechanism (for obvious reasons as we now know) it was decided that the whole thing must be a psychologic or psychic (whatever that means) process. This in turn gave further impetus to those who felt that the "cure" could be accomplished by visual training or orthoptics.

From this point of view, it would have been better to drop the term entirely and speak only of the direction, the size, shape, distance, color, etc., of the percept. This would at least avoid the confusion in deciding whether, in a given context, projection is used as a process or as a phenomenon, (i.e., an attribute of the percept). There is no objection to the use of the term in the latter sense except that it is superflous. Some authors have adopted the slightly different term "localization" in order to avoid the fallacies of the projection theory. This new term however is somewhat ambiguous since it implies both direction and distance and one must decide if either or both meanings are intended. For example when one speaks of "false localization" it is really the *direction* of the percept which is under consideration and the "projectedness" of the percept is not in question at all (*it* certainly could not be false). On the other hand the term "cyclopean projection" more often than not refers to the distance of the percept as well as its direction and again the "projectedness" of the percept at some distance is assumed.[22]

THE PROBLEM OF VISUAL DIRECTION

We have seen that all percepts are spatial and that they exist either inside or outside our sensed body depending upon the endings of the nerve paths in the cortex. The term "projection" to describe this state of affairs was found to be superfluous and misleading. It is now necessary to consider (a) where and (b) how far "outside" the percept has

[22]Of course, one can always find someone who adopts the naive view that the "cyclopean eye" (a figment of our imagination) actually does the projecting "out into space."

its phenomenal existence. Each of these is an entirely separate (although perhaps not different) phenomenon.

The first question, namely the problem of visual direction, has been reviewed by Walls (1951) and it would certainly be presumptuous to attempt to discuss in a few paragraphs a subject which requires an extensive monograph and over which gallons of ink have been spilled in the long history of visual perception. There are however a few points which deserve re-emphasis in that some confusion still persists from a failure to distinguish between subjective and objective events.

The term "visual direction" is at the outset an ambiguous one. In reviewing the literature on this matter one finds that the term is used to represent any one of the following situations:

(a) The line (or light ray) connecting a physical object to one or both (physical) eyes through the nodal point (or center of rotation) of the ocular optical system.
(b) The line connecting a physical object with an imaginary (physical) cyclopean eye situated midway between the two real eyes.
(c) The line connecting a physical object with some neural cell or area in the occipital cortex.
(d) The line connecting a perceived object with one or both physical eyes through the center of "projection."
(e) The line connecting a perceived object with an imaginary (physical) cyclopean eye.
(f) The line connecting a perceived object with an imaginary (perceptual) cyclopean eye.
(g) The line connecting a perceived object with the (visual) ego.

It is evident from the above that in order to clarify the intended meaning the term "visual direction" must be qualified. First we have to differentiate between the objective relation between physical objects among themselves and physical eyes (or a cyclopean eye) and the subjective relation of the percepts among themselves and the perceiving organism's ego. The former may be referred to as "lines of direction" the latter as "visual directions."

Figure 3 represents two physical objects A and B so situated in physical space[23] that they stimulate the retinal points A_L and A_R, and B_L and B_R. These are lines of direction. The nerve fibers from these retinal points stimulate the cortical locus A′ and B′. The physical rela-

[23]The points are chosen as lying on the theoretical (physical) horopter which is assumed to represent the spatial reflection of a perfect geometric retinal correspondence and which passes through the center of rotation of the eyes.

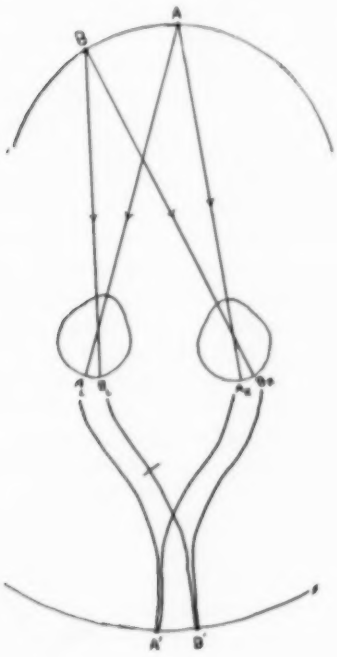

Figure III

tion of object A to object B is given and so is the physical relation of objects A and B to the two eyes and to the excitatory areas in the brain. Everything shown in this diagram exists in physical space and tells us nothing about the subjective experience of the observer. If a cyclopean eye were now introduced to represent the binocular stimulation the cyclopean eye would also exist in physical space even though it is itself an abstraction.[24]

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[24]The previous discussion has already demonstrated that physical and perceived space are not identical. It may not be out of place to state the differences again. In a recent paper, Hardy (1949—see below) describes them as follows:

"*Physical Space* is the measured mappable, blueprint space of the outside world. It is the space in which houses, railroads, bridges and streets are mapped and constructed with great precision. In measuring this space (within small tolerances), all engineers will come out with the same answer."

"*Visual Space* is the immediate, instantaneous impression we have of our environment as a three-dimensional manifold. We have an immediate sensation or impression of objects about us in relative terms: farther, nearer, larger, smaller or equal."

The subjective relation of perceived objects among themselves (relative visual direction) is determined by the locus of cortical excitation. From Müller's law we know that the excitation of different regions or sub-regions of the brain is related to sensations which are localized in different regions of subjective space (visual directions). A glance of the neuro-sensory maps of the post-central gyrus convinces us on this point. In Figure 3 for example, the cortical stimulus A′ is to the left of the cortical stimulus B′ and this relation holds no matter which way we turn our eyes. The movement of the ocular globes will determine only which of the two targets will be seen with the most acute vision.

The subjective relation of the visual percept to the perceiving organism's ego (absolute visual direction) can also have nothing to do with the position of the eyes. A given target is in a certain visual direction whether I look at it or not. The position of the visual axis cannot therefore determine the "straight-ahead" direction. As has been pointed out numerous times, if visual directions did not exist prior to eye movements such movements would be impossible. In fact, egocentric direction must clearly exist even if the subject is blind!

The egocentric nature of visual space eliminates another problem in discussions of binocular vision. Clearly, ocular duality does not enter into egocentric direction. While it is true that we have two eyes there is only one ego and all visual directions originate from it. There is only one set of egocentric directions and diplopia can only refer to the seeing of objects (or the same object) in different directions but not to a "doubling" of visual directions themselves.

The visual ego may be located in the center of visual space. Thus perceived "things" may be behind as well as in front of me.[25] Perhaps the central nature of the ego was responsible for the notions that the earth (and therefore man) is the pivot of the universe but that again is a philosophical, not a physiologic, problem.

The position of the visual ego with reference to some physical criterion such as the eyes or body or head or some point in physical space is another problem. The possibility of such a localization presupposes that either (a) visual and physical space are identical or (b) that some definite and known relation exists between them. The first assumption has been shown to be invalid so many times that nothing more need be said about it here. If this assumption were true the visual ego would be located midway between the two real eyes, say at the

[25]Of course, a visual percept can only be within my visible field at any one time. Nevertheless, when I turn my back on this paper lying in front of me it becomes perceptually "behind" me.

nodal point of the (physical) cyclopean eye. While the lack of identity between physical and visual space has been more or less widely accepted, the implication for the position of the visual ego continues to be perpetrated in textbooks and articles. To mention but one point, egocentric direction does not change with head position.

The assumption of a definitive relation (but not identity) between physical and subjective space has had considerable attention, on and off during the years. The earlier workers preoccupied with Euclidean geometry and Cartesian coordinates searched for a relation which could be expressed in these terms. These studies revealed a number of discrepancies between observed characteristics of visual space and the characteristics which that space was presumed to have on the basis of Euclidean geometry. More recently it has been postulated that the character of visual space is non-Euclidean but could be reconciled with the equations of hyperbolic geometry. This work, extensively carried out by Ames, Ogle and others and formulated in mathematical terms by the late R. Luneburg[26] has made it possible to understand some of the previously observed inconsistencies. A discussion of this assumption is beyond the scope of the present paper and the reader is referred to the discussions by Hardy,[27] Linksz,[28] Ogle,[29] Ames,[30] Fry,[31] Blank[32] and others. The implication for the position of the visual ego is that it may be inferred from the fact that visual and visible space have certain metrics in common.[33] At present however it appears that nothing more definite can be said about it particularly in view of the fact that the Luneburg equations involve personal constants which we do not yet understand

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[26]Luneberg, R., "Mathematical Analysis of Binocular Vision." Princeton Univ. Press, Princeton, 1947.

[27]Hardy, L. H., "Investigation of Visual Space." Arch. Ophth., 42:551-561, 1949.

[28]Linksz, A., "Physiology of the Eye. Vol. II. Vision." Grune and Stratton, N. Y., 1952.

[29]Ogle, K. N., "Researches in Binocular Vision." Saunders, Philadelphia, 1950.

[30]Ames, A., "Binocular Vision in Commonplace Environments," *Am. J. Psychol.*, 49:333, 1946.

[31]Fry, G., "Visual Perception of Space." Am. J. Optom. and Arch. Amer. Acad. Optom., 27:531, 1950, and "Further Comments on Luneburg's Analysis of Binocular Vision." Am. J. Optom. and Arch. Amer. Acad. Optom., 29:260, 1952.

[32]Blank, A., "The Luneburg Theory of Binocular Visual Space." *J. Opt. Soc. Am.*, 43:717-729, 1953.

[33]In a recent paper, Walls ("A Theory of Ocular Dominance," Arch. Ophth., 45:387-412, 1951) locates the visual ego at the perspective center of the dominant eye on the basis of "sighting dominance" tests. He states, however, that in "impartial eyed" persons "the punctate locus of the binocular visual ego may be mobile and impermanent, or it may be in the median cyclopean position of Hering's 'binoculus.'"

(see for example Hardy, Rand, and Rittler, *Arch. Ophth.* 45:53, 1951).

The independence of egocentric from oculocentric directions raises a number of interesting questions. First, in what manner is this independence maintained? It is because egocentric directions are somehow rigidly built into our perceptual mechanism (reminiscent of Kant)—a view suggested by the presence of such a system even in congenitally blind individuals? Or is it that oculocentric directions are somehow cancelled (by the "proprioceptive backstroke" of some or the "record of innervation" of others) so that the two factors through mutual interplay come up with the right answer? Second, what are the influences which affect the stability of egocentric directions and in what manner, for example, does the effect of vestibular impulses differ from the ocular? Third, are the fixed egocentric directions for a patient with concomitant strabismus similar or different from the normal and, since they are fixed, how can we account for the peculiarities of strabismic seeing in motor terms? These are just a few of the questions which must be settled if our understanding of clinical problems of binocular vision are ever to be placed on a rational basis. Perhaps there is more than one ego—a visual, a tactual, an auditory, etc., and an "overall" ego. Psychiatry has found it necessary to postulate several types of ego. It may be necessary to repeat this division of labor for the perceptual hierarchy as well.

THE PROBLEM OF VISUAL DISTANCE

In dealing with the problem of the distances of perceived objects one must again differentiate between objective and perceived distance. The oft-quoted example of the two distances of the sun (physical and subjective) may be mentioned in this connection. Perceived distances are always finite wheras physical distances may (for all practical purposes) be infinite.

As was done in dealing with visual directions it is useful to distinguish between absolute and relative visual distances. Absolute distance is the perceived distance of a visual object from our ego—from us. Relative distance is the perceived distance relation of one percept with reference to other visual percepts (including the parts of our own body which may be present in our visible field).

Absolute visual distance is notoriously poor in man—particularly beyond the range where the convergence angle is effective (i.e., about two meters). Within this range, the position of the "Luneburg Horizon" (as set by the Vieth-Müller torus which is in turn determined by the convergence angle or distance), plays a contributing role. Outside this range, relative distance as determined by monocular (so-called) cues, reenforced by binocular disparation, has to provide the necessary infor-

mation. A further elaboration on the problems involved in this area will be presented in a separate paper.

Our discussion has demonstrated that in dealing with visual phenomena, particularly those involving the use of the two eyes, one can nowadays arrive at more satisfactory explanations (i.e., having greater probabilities) because of a considerable body of experimental data obtained by modern investigation and the more sophisticated way we have learned to ask our questions. But it would be unrealistic indeed to expect that all our questions concerning this subject can now be satisfactorily answered. We don't wish to repeat the error of the 19th century physicists lamenting, like Alexander, that there was nothing worth-while left to be discovered. We have attempted to take a more realistic, albeit conservative view of the situation.

ACKNOWLEDGMENT

The author acknowledges with gratitude and respect the help and stimulation derived from the writings of Professor Arthur Linksz of the Postgraduate School of Medicine, New York University. The clarity of his thinking and the rigor of his analyses can only be appreciated by those who, at one time or another, have wrestled with similar problems concerning the perceptual aspects of vision. One may not agree with everything in his second volume of the "Physiology of the Eye" but few books will be found which are as powerful a catalyst in crystallizing one's thinking.

ANNOUNCEMENT

NATIONAL BOARD MEMBERS REAPPOINTED

Dr. Harold M. Fisher, New York City, and Dr. John R. Uglum, Mitchell, South Dakota, were re-appointed to serve second terms on the National Board of Examiners in Optometry. Both are charter members of the Board, having been appointed by the International Association of Boards when the National Board was created in 1951. Dr. Fisher is presently serving as President and Dr. Uglum as Secretary-Treasurer.

THE CORRECTION OF SUBNORMAL VISION— A NEW DEVELOPMENT*

Norman Bier†
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If a person is partially blind, he must also be partially sighted. The emphasis today is on making the most of whatever vision there is and developing it so that the patient can utilize it in a practical every day capacity. The psychological inference of this is all important and offers the basis for patient and practitioner alike in the clinical procedure and treatment.

DESIGN OF LENSES

The lenses must be so constructed as to spread the light rays over a wide retinal area or to divert the image onto an unaffected part of the retina. For this, the retinal image must be magnified. Separate lenses or lens systems may be necessary for distance and near vision to achieve this. This has called for the designing and development of new telescopic and high-powered lenses.

The elimination of the various aberrations is extremely difficult and it is impossible to correct them all completely. The one principally due to the material of the lens is chromatic aberration, including chromatic difference of magnification. The form of the lens governs the spherical aberration, coma, oblique astigmatism, curvature of field and distortion. A compromise must be struck in the final design since some of these aberrations can be most disturbing clinically while others may be permissible. "Bending" of the lens surfaces and employment of aspherical surfaces considerably help in the creation of a wide field of view thereby removing the main criticism of earlier designs. I propose to give comparative figures and to show what clinical significance the different forms of lenses and lens systems have on distance and near vision. The correction of distance and near sight calls for independent treatment, also for different forms of lenses.

Dealing with distance first, apart from the optical and field corrections peculiar to telescopic systems, it is essential that the unit is as compact as possible so that the lenses, if need be, can be worn as a permanent rather than occasional prescription. Many partially-sighted people are very sensitive about the aesthetic factor and would rather tolerate

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reduced vision than have attention focussed on their debility. The tube effect of a telescopic system may give the impression of a narrower field than is actually the case. This difference is reduced in a more compact system. The problem of attaining an adequate degree of magnification which controls the resolving power of the unit, in a compact design with a wide field of vision, is a considerable one.

The principle employed to retain an erect image is, of course, the Galilean one with a positive front and negative eye lens. I have experimented with numerous types and forms of glass and plastic spherical and aspherical lenses and lens separations, but will not dwell on the many variations tried in an effort to achieve a compact system, comparatively light in weight and giving a good field of vision. Clinically, I have found it desirable to have a variation rather than fixed degree of magnification, my investigations centering on 1.60x—2.40x systems, but more specifically on 1.80x, 2x and 2.30x lenses. The 2.30x lens is now not employed in the standard fitting case because of its smaller field. My final distance lenses are composed of one plastic unit and one completely of glass. The latter has two pairs of achromatic doubles and is designed for a 1.80x and 2x magnification. The all plastic unit—I believe the first of its kind to be produced anywhere—comprises an all aspherical system, i.e., one aspherical surface each on the O.G. and E.P. lenses and giving similar degrees of magnification. See Figure 1. A

Fig. 1. From right to left, an all-plastic 2x, 1.8x telescopic lens and near cap.

fractional difference in the magnification could purposely be introduced in a fitting set, e.g., one pair each 1.75 and 1.80x, 2 and 2.10x. Clinically this can be useful but the difference must be kept low enough to make fusion and binocular testing possible.

Table I sets out the differences in the total and central fields of clear vision between the plastic and glass lens units. It will be seen that the glass system gives a well corrected full field whereas the plastic unit produces some chromatism and distortion peripherally. Similar pros and

TABLE I.
Distance Lenses.

Magnification of Bier Distance Lens P—plastic unit G—glass unit	Field of Vision (in degrees) Total	Clear
1.80 x G	21	18
1.80 x P	23	15
2.00 x G	19°5—(X)	16
2.00 x P	21	13
2.30 x G	15	12

X—Experiments not yet concluded.

cons which appertain to plastic and glass spectacle lenses apply to these telescopic lenses. The one gives a clearer field, is heavier, possibly breakable and more costly. The plastic unit would be lighter, virtually unbreakable but more susceptible to surface scratches. It has a smaller central but greater total field and is a better economic proposition. See Figure 2.

Fig. 2. Frontal view of two glass distance lenses, 2x Unit in R.E., 1.80x in L.E., on left. Two all plastic distance lenses (1.80x) in center. Plastic 1.80x lens in R.E., glass 1.80x in L.E. on right.

A definite place seems to be present for both constructions, each possessing certain advantages. The most suitable lens for an individual is best assessed during the course of the examination. Where the patient is not disturbed by the peripheral aberrations, the plastic unit would appear to be the more desirable. It is debatable whether it is better to have a totally larger field with peripheral aberrations but a clear central field, or a smaller but clear field altogether. This can only be determined clinically, hence the adoption of the two materials in the fitting set. The difference in weight between the plastic and glass 1.80x lenses, for example, is over three quarters of an ounce, the plastic weighing just

over half an ounce, against not quite an ounce and a half in glass. The total depth or thickness is 24mm. in plastic and 23 mm. in glass, from a frontal view the appearance is little different to that of a high-powered lenticular spectacle lens. See Figure 3.

Fig. 3. Side view of all plastic telescopic distance lens on left. Side view of the glass telescopic distance lens on right.

We have observed that subnormal vision patients find chromatic aberration the least troublesome factor of all those which have to be considered since many of them possess a defect in their colour perception.

By experimenting with a combined system of plastic O.G. and glass E.P. lenses I was able to reduce some of the peripheral aberrations present in the all plastic unit but have not so far found sufficient clinical improvement over the separate glass and plastic systems. I am also experimenting with a prism combination, as yet with inconclusive results.

If a positive lens is added, then the distance lens system can be used for near. The field, however, is smaller than with a separate near lens but the great value of this combination lies in the longer working distance offered. See Figure 7. Typing and playing the piano, for example, are two of the visual tasks possible with a combination like this; a near correction alone may not enable the patient to see at these intermediate distances. As can be seen from Table II the magnification increases with an increase of the positive lens addition, but with it there is also a reduction in the working distance. The useful resolution lies around 3x with a maximum of 4-5x. The working distance is approximately doubled with a telescopic lens focussed for near in comparison to a separate near lens of the same magnification.

The magnification principle offered by high-powered positive lenses for near has recently been given a lot of publicity and thought. Fein-

TABLE II.

Total magnification of telescopic distance lenses combined with near addition and resultant field of view with object in focal plane.

Near Addition	With 1.80 x Lens resultant magnification	field of view (in cm.)	With 2 x Lens resultant magnification	field of view (in cm.)	With 2.30 x Lens resultant magnification	field of view (in cm.)
+4 D.S.	1.8 x	8	2 x	7	2.3 x	5.7
+6 D.S.	2.7 x	6	3 x	5	3.5 x	4
+8 D.S.	3.6 x	4.5	4 x	4	4.6 x	3
+10 D.S.	4.5 x	3.5	5 x	3	5.8 x	2.5

bloom has drawn attention to their clinical value in the form of spectacle rather than separate magnifying lenses for reading and close work.

Lederer more recently computed a series of three lenses with simple spherical surfaces based on the "best-form" principle with the object in the focal plane. We are familiar with their simplicity in design yet excellent performance. They compare very favorably with the Feinbloom microscopic lenses in the given range of 2.5x to 6x. The microscopic lenses just referred to comprise a combination of 1-3 glass lenses some of them with aspherical surfaces, their range extending to as high as 20x magnification. Although I have occasionally found it of service to go beyond the Lederer 6x limit, I have not tried lenses beyond a magnification of 10x, i.e., approximately +40.00 D.S. Graf Wiser's technique, so well described by W. Friang, who makes regular use of these higher magnifications, though clinically there is rarely need to go beyond 8x.

These lenses are used monocularly with a very short working distance and the print has to be held near the tip of the nose in the focal plane of the lens. Slight variations in the eye-to-lens-distance are sufficient to compensate for spherical and most astigmatic ametropia. The higher the power of the lens the more critical the reading distance. Therefore, the lowest power lens with which satisfactory results can be obtained should always be prescribed. A higher magnification, however, should not be avoided if better acuity is possible. Distortion and oblique astigmatism in particular can appreciably reduce the field of view.

My own work with near lenses is centered on the use of plastic aspherical lenses and I think that they have the best future, particularly in the higher powers, in view of their much wider field of clear vision and lightness in weight.

I have carried out numerous experiments and have analyzed my clinical observations in Table III. From these, for example, it can be seen that the most recent Lederer-type lenses distinctly extend the field of

TABLE III.

Field of vision with near lenses, expressed in degrees and cms. Object in focal plane. P.N. width of normal newspaper column is 5 cms.

Type of Lens	2.5 x		3 x		3.5 x		4 x		5 x		6 x		7.5 x		8 x	
	T	C	T	C	T	C	T	C	T	C	T	C	T	C	T	C
Lederer	72°	69°					70°	56°			54°	43°				
	15	14					10	7.5			5	4				
	cm	cm					cm	cm			cm	cm				
Lederer-Type (Stigmagna)			73°	67°			65°	60°	63°	51°						
			13.5	12			9	8.0	7	5.5						
			cm	cm			cm	cm	cm	cm						
Best-Form Plastic (Igard)			58°	53°			60°	54°	55°	47°						
			10	9			8	7.2	6	5						
			cm	cm			cm	cm	cm	cm						
Feinbloom (Microscopic)							56°	54°			54°	50°			52°	48°
							7.5	7.2			5	4.6			3.8	3.5
							cm	cm			cm	cm			cm	cm
Bier Near-Vision (Plastic aspherical)					87°	79°			76°	70°	59°	54°	63°	57°		
					15	13			9	8	5.6	5	5	4.4		
					cm	cm			cm	cm	cm	cm	cm	cm		

T—Total field. C—Clear field.

TABLE IV.

Maximum Near Lens Sizes.

Type of Lens	2.5 x	3 x	3.5 x	4 x	5 x	6 x	7.5 x	8 x
Lederer	36 mm			36 mm		34 mm		
Lederer-Type (Stigmagna)		42 mm		40 mm	38 mm			
Best-Form Plastic (Igard)		32 mm		32 mm	32 mm			
Feinbloom (Microscopic)				29 mm		29 mm		29 mm
Bier Near-Vision (Plastic aspherical)			50 mm		50 mm	45 mm	38 mm	

view in comparison to the original Lederer formulae. The Feinbloom microscopic, original Lederer and even conventional spherical plastic lenses do not give dissimilar results. It can be clearly seen that an appreciable extension in the field is possible with plastic aspherical lenses. The size of the lens naturally governs the total field provided undistorted vision is obtainable over the entire aperture. In Table IV are set out the maximum lens sizes either stated by the designer or practicable. This is of some importance, as it is with conventional spectacles. The maximum eye size cannot always be prescribed and is governed by the interpupillary distance, the spread of nose, and to some extent the temporal width of the face where the extra field, which can be so valuable to these patients, would otherwise be lost. For example a patient with an interpupillary distance of 60 mm. would not derive more benefit from a lens blank size exceeding, say, 38-40 mm. and can therefore be covered by the Lederer type of lens. On the other hand one with a P.D. of 68 mm. would get a much wider field with the use of a plastic aspherical lens. See Figures 6a and b. Theoretically, the diameter of plastic aspherical lenses could be extended beyond 50 mm.

The given introduction on the design and factors that have to be satisfied with these special distance and near lenses can of necessity touch only upon some of the many problems appertaining to the use of high-powered lenses and systems. It may now help to clarify their clinical application both physical and psychological. It is necessary to understand the peculiar problems of vision and personality attached to the examination and correction of the partially-sighted patient.

THE EXAMINATION

The minimum distance visual requirement either with or without ordinary spectacles is finger-counting at 2 m., the approximate equivalent of 2/60. Patients with sight like this would be classified as blind. I would consider a patient to have subnormal vision if conventional refracting lenses do not give vision of 6/18 or better. The theoretical improvement should be at least in proportion to the magnification, for example 3/60 to 6/60 or 6/36 to 6/18 with a 2x system. The actual improvement possible may substantially exceed the theoretical expectation: for example, a best spectacle V.A. of 6/60 may be brought up to the equivalent of 6/18; at near, Jaeger 9 to Jaeger 2.

The type of improvement which is possible, the patient's response and his chances of visual rehabilitation depend upon a number of factors, such as the case history, type of ocular condition and date of onset. A preliminary investigation to assess the possibilities of the

various subnormal vision aids should always be carried out in the first instance. Each patient must be judged on his merits: what may mean better sight for one person may be disappointing to another. The subnormal vision patient generally welcomes any improvement in sight, however slight, and can utilize it in a manner quite unthought of by a person with normal vision. Some of these patients can be helped for distance and near; in others only the near vision may warrant correction.

In outlining the examination procedure I have adopted, I would like to stress that this routine is not necessarily followed precisely in every case, as dealing with the human element demands a degree of flexibility in approach and behaviour according to the requirements of the individual patient. Long travelling distances may, for example, limit the number of visits. As mentioned, a preliminary investigation is always carried out on the first visit. If the outcome of this has not proved altogether negative a more complete examination is carried out at the second visit. After dispensing the special lenses further consultations for visual training, proper adaptation and utilization of the correction are called for in the process of rehabilitating the patient. A total of three to eight visits may be necessary to conclude the complete case.

THE PRELIMINARY INVESTIGATION

On the first visit the case history is taken, signs and symptoms are noted, and a note made as to whether the loss in sight is recent or long-standing. The patient is first referred to an ophthalmologist if an active pathological condition is suspected.

A useful picture as to the patient's present visual capabilities can be formed as he enters the consulting room. It is noted, for example, whether he came alone or was accompanied, whether or not he uses a stick, how he moves about, what is his head posture and that of the eyes. The emotional state of the patient can be an important factor in the initial examination: the patient may expect a great deal from this visit and in consequence be keyed up, tense, over-expectant and nervous, all factors which will not assist the investigations. For this reason, not too much emphasis should be placed at this stage on a detailed medical history lest the patient begin to dwell on his fate and difficulties and feel sorry for himself. Apart from the essential facts, a detailed case history can be taken on a later visit, many of these patients have "made the rounds" and know a great deal about their ocular condition, opinions given and prognosis. If the patient displays tendencies towards depression and resignation, he may need moral encouragement; on the other hand, over-enthusiasm could lead to later disappointment. Where loss

of vision has been fairly recent it is usually difficult to deal with the patient as he may still hope to regain the sight he remembers. It may be advisable for him to wait until he is more prepared to make the necessary effort required to interpret the better sight possible, though different from the vision he once knew.

The separate approach required in the correction of distance and near vision has already been stated. The patient should, therefore, be closely questioned as to which he attaches greater should, bearing in mind his occupation and daily habits. There are patients who may be handicapped primarily when attempting close work: others may find the opposite and many experience difficulty in both. Some aspire only to view television or to read while others are mainly concerned with their poor distance sight. The child who may never have enjoyed proper sight or who is forced to visit a special school or institution for the blind deserves particular care and attention to enable him to overcome his visual handicap and fit into the society of the seeing. The educational and social adjustment may prove a long and tedious business: unfortunately there is a lot of apathy in official quarters, not only in this country. I feel that a lot more could be done for these unfortunate children given the cooperation and opportunity. Older patients with more fixed habits and easily prone to fatigue, call for different attention than that given to younger people whose temperament and outlook on life may more readily produce the necessary visual adjustment and perseverance.

The examination should follow the familiar pattern. The ophthalmoscopy and slit-lamp, if available, will reveal any active pathology. These will reveal whether the reduced vision is due to an obscurity situated anteriorly, in the lens or vitreous, the state of the fundus and in particular the area affected, either central or peripheral. The extent of retinal destruction, whether localized or general, may help to assess the area over which the magnified image could be spread. Whatever the state of the fundus, an open mind must be retained without drawing conclusions from the ophthalmoscopy. Speculations based on the ophthalmoscopy alone can forestall visual improvement which may well prove possible.

The patient's spectacles should be superficially verified both subjectively and objectively where possible and the resultant visual acuities recorded monocularly and binocularly, attention being paid to whether both or just one of the eyes would warrant correction. The refraction must be reasonably accurate as any distance magnifying device will not only enlarge the retinal image but also the blur circles. If there are two seeing eyes, dominancy and their relative difference may be important

later. As a chart, I use a normally illuminated Landolt-ring hand card which can be brought to and fro and also turned to prevent the patient memorizing the gaps in the letters.

The telescopic lens is next fixed monocularly in front of the spectacle correction and the patient allowed to centre it himself to give the best acuity. The process is repeated in the other eye and then binocularly. A large percentage of subnormal vision patients are found to possess only one sound eye. Figure 4.

Fig. 4. In the examination the patient should be allowed to tilt the head if better vision is possible. An appropriate allowance may have to be made in the final spectacles.

If the sight can be improved for distance, a near-cap can be fitted on to the distance lens but in view of the convergence, only monocular correction is possible. Where there are two seeing eyes, the patient can alternate occlusion with a Chavasse glass cap. In this way with the use of various power near caps the one lens can be utilized for distance, intermediate and near vision. Where insufficient resolution is obtained at near, the patient may be better served by an additional pair of higher powered reading spectacles. There are some patients whose distance vision cannot be adequately assisted but whose near vision can be helped.

After having demonstrated the visual improvement, as well as the limitations and advantages of the device, the decision to go further is then left entirely to the patient. He is asked to think for a few days about the findings, choice of lens and advice given and to arrange a further appointment if sure about proceeding. Few cases are hopeless but no influence should ever be brought to bear on the patient for he must himself work for a visual improvement. If insufficient aid is possible the patient is naturally advised against continuing.

THE REFRACTION

The previous screening test having established that some assistance is possible, the patient now attends for his second visit to have a more thorough refractive examination and precise test of the special distance and/or near lenses required. Usually the patient shows more willingness at this consultation; he is also already familiar with the type of lens and his efforts to see may be less spasmodic and more deliberate. Generally, slightly better results can be recorded on this visit than on the first but with a few, surprisingly, the opposite may also apply. After exerting his utmost energy to read the chart initially, the patient may not be able to make the same effort again.

After the tests have been completed and exact frame and facial measurements taken, the selection is made as to the appropriate type of distance and/or near spectacles.

If a single distance telescopic lens for permanent use is decided upon, the poorer eye may be fitted with a chavasse glass. See Figure 5.

Fig. 5. Patient fitted with an all plastic 2x distance lens in the R. E., Chavasse glass in the L.E. A balancing telescopic dummy lens would give a better cosmetic appearance.

For cosmetic reasons the patient may prefer to balance the other eye with a dummy telescopic lens, which is best done with a plastic unit irrespective of whether a glass or plastic lens is employed before the other eye, to cut down the weight.

If telescopic lenses are indicated for occasional use only, such as cinema, theatre, music, etc., the cosmetic factor may be less important and simpler telescopic spectacles may suffice. Appropriate reading caps, possibly of different power to extend the near focus, may have to be fitted. Where the standard telescopic lenses fail to give adequate distance or near sight, a wider field system, often of the same magnifica-

tion but possibly more cumbersome in construction, may sometimes offer a pronounced visual improvement. These tests are largely subjective in nature.

If reading spectacles exclusively or additionally are called for, the better eye should be corrected. Where the patient uses both eyes, it may prove advantageous to give a different magnification for each, offering alternate working distances, e.g., writing with the longer focus lens and reading with the shorter; alternatively the better eye used for distance and the weaker for near. Binocular correction is impracticable with such high powers and the patient soon learns to suppress either eye in view of the pronounced blur apparent when outside the critical plane of sharp focus. See Figure 6. Where we have only corrected the

Fig. 6. Patient with 5x Lederer-type lens in R.E. (left illustration). Comparative view with 5x Bier Plastic Aspherical lens in R.E. giving 35% wider field, on right.

near sight, patients have sometimes observed a noteworthy improvement of their distance and general vision after daily use of their spectacles. Regular visual exercise of their eyes may account for this interesting phenomenon, adding support to Graf Wiser's findings.

VISUAL TRAINING

The third visit is devoted to teaching the patient to see with a different part of the eye to that which he either is or has been accustomed. This may involve a complete re-orientation and new co-ordination of the visual and allied mechanism, a task parallel to that of a child learning to walk. Much perseverance and patience may be called for by both patient and practitioner. Reading exercises at distance or near or both, depending upon the correction to be given and general advice on home exercises, can occupy a full hour. More visits may be necessary, subject to the patient's progress and confidence.

If the patient's own lenses are not yet at hand, trial lenses are used in preparing the patient for his final spectacles. The procedure is, of course, a simpler one if only near spectacles or those for occasional use are prescribed.

REHABILITATION

The final spectacles are checked for fit and vision. They have to be centered and angled precisely; where there is eccentric fixation or nystagmoid movement a few degrees of tilt in the plane of the lens may be found to give clearer sight. This may have been previously established, see **Figure 4.**

Individual reaction to the new lenses may be one of joy or disappointment. Some will have harbored higher hopes, remembering, so they think, even better sight during the examination when the contrast to them was naturally more pronounced. To others the new found vision may come as a shock. In all cases, rehabilitation should be gradual. Tiring which is frequently experienced in earlier stages should be avoided. The process is of necessity a slow one.

The patient is now given full and detailed instructions on how to get accustomed to the spectacles. Difficulties that may be experienced initially should be stated but every effort made to encourage the patient to any improvement that might be possible.

Attention to good lighting without shadows, the need for head rather than eye movement while using distance lenses, the desirability of exact adjustment of the reading or working distance in the case of near lenses, the daily use of the spectacles to be gradually increased, the care of lenses and the general limitations applicable to all magnifying devices are all discussed with the patient. See Figure 7.

PROGRESS REPORT

On the final visit, the patient can relate the progress he has made with the spectacles and present any problems that he may have experienced. A general talk can reveal a number of points which may add to the experience of the practitioner for future cases. The patient may benefit by further advice, or minor adjustment of the appliance.

CASE REPORTS

Four cases have been selected, considered representative of the demands made by the partially-sighted and correction effected.

R.H.S.—Age 36. (Male). This patient has a case of recurrent uveitis. Detached retina caused complete loss of sight in L.E. He has been myopic since 7 years of age with normal vision in both eyes until 3 years ago. He has regularly attended hospital, and has had an unsuc-

Fig. 7. Showing patient on left with 2.5x near lens engaged in reading. Note position of light. At right a longer working distance is possible with similar 2.5x magnification in a telescopic lens fitted with near cap. Working distance is approximately doubled with telescopic lens focussed for near in comparison to separate near lens of same magnification.

cessful operation in L.E. and subsequent treatment for both. The patient is attending a Braille Course at present. He has had to give up his business career since affliction. His ophthalmologist recommended telescopic lenses.

R. V.A. 4/60 with own spectacle Rx. of—4.00 D.S. ⊂ +1.75 D.C. axis 5.

L. V.A. Perception of light only, 30° divergent strabismus.

Reads Jaeger 4 with naked R.E., patient is primarily concerned with distance vision.

R.E. with 2.1x lens and —6.00 D.S. auxiliary lens, V.A. = 6/24+. With +6.00 D.S. near cap = Jaeger 1.

Correction of R.E. for distance given with a near cap addition for typing.

E.C.F.—Age 79 years. (Male). The patient has "poor eyes" since childhood. Sight began to fail 20 years ago. Damaged the cornea of L.E. which was formerly the better one, in an accident 2 years ago. Tried contact lenses but these gave no improvement. The patient has seen numerous eye specialists, and a corneal graft was suggested but refused by patient. He is a farmer leading an active life, and drives a car using a helper to act as "look out." He has several spectacles but finds an old pair obtained 30 years ago best of all. He is concerned with a general improvement in sight, particularly for concentrated distance and near vision.

Ophthalmoscopy showed corneal leucomata, fairly central and

more pronounced in L.E. High corneal astigmatism. Media hazy with fundus examination very difficult O.U. His refraction was:

R.E. —12.00 D.C. axis 60. V.A. = 6/60.

L.E. +1.50 D.S. ⊂ —8.75 D.C. axis 75. V.A. = 3/60—.

With a 1.8x lens, R.V.A. = 6/18+. L.V.A. = 6/18—. Binocular V.A. = 6/12.

With a +7.00 D.S. near cap addition R.E. = Jaeger 2, L.E. = Jaeger 3.

Binocular correction given for distance vision, with near addition and Chavasse glass caps for alternating between right and left eye.

V.E.B.—Age 33 years. (Female). This patient has had a macular degeneration since 14 years of age with normal eyes until then. Not much deterioration since onset. Both eyes equally affected. She was told that no improvement was possible medically or optically. She has tried telescopic spectacles in the past but found no improvement. She can see very large print such as headlines in newspapers. She manages to follow a normal daily life, visits cinema occasionally but frequently watches television. No spectacles are now worn. Ophthalmoscopy confirmed macular degeneration which seemed to be more advanced in R.E., apart from this there was no fundus involvement. Her refraction was:

R.E. —0.25 D.S. = F/C at 3 metres, or 2½/60.

L.E. +1.00 D.S. = 3/60. B.E. = 3/60.

With a 2x lens the distance vision in either eye could not be improved beyond 3/36+, with a slight drop binocularly. L.E. dominance was clearly shown. With near cap fitted of +8.00 D.S., Jaeger 6 was best possible. With a +2.00 D.S. near cap, patient could just manage to read simple music. With a Lederer 4x in front of the L.E. the patient could read Jaeger 4-5 and normal newspaper and book print. The longer working distance was preferred over the 6x lens which gave Jaeger 2.

At this stage the patient was fitted in the L.E. with a 4x lens for reading but may later have an additional telescopic Rx. for music. Distance lenses were not warranted as sufficient improvement could not be effected.

B.S.—Age 59 years. (Male). This patient has been diabetic for the past 24 years. He had perfect sight until 1949. L.E. then developed a hemorrhage with resultant near-total loss of vision. R.E. remained normal until 1952 and has since been getting increasingly weaker though fairly stationary of late. Apart from the ocular trouble the patient's general health is poor. He uses a magnifying glass for R.E., as spectacles do not help.

The ophthalmoscopy revealed a partial cataract in the R.E., clear media but retinal changes. The L.E. showed a near-complete cataract. The vision in the R.E. was recorded as F/C at 2½ metres. With a refractive error of +1.00 D.S. corrected, and a 1.8x distance lens the V.A. could be improved to 3/36+ or 6/60+. A 2.1 lens gave 6/36—. With a +8.00 D.S. Near Cap fitted, the patient could attain Jaeger 4.

A separate reading 5x plastic aspherical lens gave J.3+ or J.2—, patient's P.D. was 70 and full benefit of the wider field could therefore be obtained. No help could be given in the L.E. For the R.E. the patient had the 5x reading correction using an ordinary +9.00 D.S., meniscus lens for writing and was advised to attend again later, when fully accustomed, to have a distance lens.

CONCLUSION

It is so tempting to say "no more can be done" after conventional therapeutics, surgery or refractive aids have failed. It is true that a number of partially-sighted patients are not prepared to make the necessary effort to see and to adapt to the special lenses now available, as they are satisfied in their own blurred world or afraid to loose the benefits in the form of pensions, family protection or even pity that blindness has bestowed upon them. But there is a much larger number who grasp any help if their sight can be improved. Our attention must be focussed on them, stressing their seeing abilities, however slight, rather than dwelling on their weaknesses or handicap. Understanding the mentality and problems of the partially-sighted goes a long way towards rehabilitating these patients.

During the three years in which I have been engaged with this subject I have seen about one hundred patients. Of these 80% could derive benefit from the lenses described and some of the results have indeed proved remarkable. A few could be helped merely by prescribing ordinary lenses. Feinbloom and Lederer report similar findings, for example, of patients able to read newspapers and books again for the first time in 20 years or otherwise enabled to lead a useful life. Patients with subnormal vision deserve special attention and it is hoped that the number of practitioners doing this work will increase.

Of all those who have carried out investigations, I must single out the work of William Feinbloom of the United States, who has been active in this field for 25 years. His pioneering spirit and outstanding contributions to the design of special lenses as well as his thorough understanding in the examination of the partially-sighted deserve particular mention. His methods have been widely followed and are also described by Neill and Freeman.

My experiments could not have been carried out without the co-operation of patients, technicians and colleagues. I would like to express my gratitude to them, in particular to Mr. P. Fairbanks of the Northampton Polytechnic, Mr. W. Pyke, Technical Officer of the Royal National Institute for the Blind, Miss M. Neild and Mrs. J. Folliguet.

SUMMARY

A series of new distance and near lenses for the correction of the partially-blind patient is being presented; a procedure of examination and treatment is described; a change in professional and lay outlook towards the partially-sighted is called for.

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REFERENCES

Feinbloom, W. Outline of the technique of examination of the partially-blind patient with the clear image lens. The Bulletin of the Optical Society of the City of New York. 1953.

Freeman, E. Optometric Rehabilitation of the Partially-Blind—A Report on 175 cases. American Journal of Optometry and Archives of American Academy of Optometry. May, 1954.

Friang, W. Subnormal Vision: Some experiences in treatment by the method of Graf Wiser. Transactions of the International Optical Congress, 1951.

Levy, A. H. Telescopic Spectacles. British Medical Journal, September, 1928, and British Journal of Ophthalmology, December, 1929.

Neill, J. C. The New Clear Image Lens. Pennsylvania State College of Optometry, Alumni Bulletin, March-April, 1953.

Obrig, T. E. Telescopic Spectacles. Modern ophthalmic lenses and optical glass. 1935, pages 143-169.

Pascal & Noyes. Hopes and Helps of the Blind and Near-Blind. Chapter 22. The Optometrist's Handbook of Eye Diseases.

ANNOUNCEMENT

A NEW ABSTRACT JOURNAL

In February 1956 the first issue of SURVEY OF OPHTHALMOLOGY will appear. It will be a bimonthly of 600 pages a year, at $9 a year.

The editor will be Dr. Frank W. Newell, Chief of the Section of Ophthalmology and Associate Professor of Ophthalmology at the University of Chicago. He will have the assistance of a board of 40 ophthalmologists. A section on refraction will make this abstract journal of value to optometrists.

Every aspect of the subject will be covered and editorial comments following the abstracts will add to the value of these. Occasional original reviews of subjects in the field will be a feature.

The Williams & Wilkins Company, Mt. Royal and Guilford Avenues, Baltimore, Maryland, will be the publishers.

MORALITY AND PROFESSIONALISM*

Eugene Freeman†
Chicago College of Optometry
Chicago, Illinois

The professions are uniquely distinguished from all other vocations by their codes of ethics. Only the professions require their members to pledge themselves to place the interests of their patients or clients above their own. Only the professions require their members to subscribe to a more rigorous set of morality rules than would be required of them if they were engaged in any other kind of a vocation. Professional people, as a group, are expected to be more honorable than any other group.

This paper is concerned with the nature of the moral obligations imposed upon the professional man by his acceptance of membership in his profession. Are the morality rules in his codes of ethics merely hypocritical verbal statements made to allay the suspicions of a gullible and easily duped public? Or are they simply vaporous expressions of ideals which are so elevated and lofty that they are unattainable by human beings, and would be useful only as a guide for saints or super-moral persons? Perhaps these morality rules are a reflection of what Bishop Joseph Butler (1692-1752) would have called *Cool Self-Love* and *Benevolence*, or what John Stuart Mill would have called *Enlightened Self Interest*, or what Immanuel Kant would have called *Moral Duty*, or what Plato and Aristotle would have called *The Good*. Suppose we investigate some of these possibilities.

In his preface to "The Doctor's Dilemma," George Bernard Shaw, in speaking of the honor of doctors, says:

> "They have as much (honor) as any other class of men, no more and no less. And, what other men dare to pretend to be impartial where they have a strong pecuniary interest on one side? Nobody supposes the doctors are less virtuous than judges: but a judge whose salary and reputation depend on whether the verdict was for the plaintiff or defendant, prosecutor or prisoner, would be as little trusted as a general in the pay of the enemy. To offer me a doctor as my judge, and then weigh his decision with a bribe of a large sum of money and a virtual guarantee that if he makes a mistake it can never be proved against him, is to go wildly beyond the ascertained strain which human nature will bear. It is simply unscientific to allege or believe that doctors do not under existing circumstances perform unnecessarily operations and manufacture and prolong lucrative illnesses."

R. H. Tawney, on the other hand, in his book "The Acquisitive

*Read before the annual meeting of the American Academy of Optometry, Toronto, Ontario, Canada, December 11, 1954. For publication in the September, 1955, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

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Society," offers a much more favorable interpretation of the moral basis of the professions. He writes:

> "A profession is not simply a collection of individuals who get a living for themselves by the same kind of work. Nor is it merely a group which is organized exclusively for the economic protection of its members, though that is normally among its purposes. . . . Its essence is that it assumes certain responsibilities for the competence of its members and the quality of its wares, and that it deliberately prohibits certain kinds of conduct on the grounds that though they may be profitable to the individual, they are calculated to bring into disrepute the organization to which he belongs."

Tawney's view offers a simple answer to the indignant charges made by Shaw. Presupposed in Shaw's indictment is the point of view known as *psychological hedonism:* That the only possible motive of conduct is the aim of obtaining pleasure for oneself. This is why Shaw declares that the temptations for exploiting patients are so great that it would be straining human nature beyond the limits which it can bear to expect that the doctor (who, like everyone else, is motivated to seek nothing but his own pleasure) could possibly withstand these temptations.

But even if we were to grant the pre-supposed tenets of psychological hedonism, that no one acts except in the furtherance of his own pleasures and selfish desires, it would not follow that it would be contrary to human nature for doctors to withstand temptation and act in such a way as to serve the interests of their patients. In a word, suppose for the sake of argument that doctors were thoroughly selfish in all their actions. Then whether or not they would cheat their patients would depend not on the limitations of human nature, but on the quality of their intelligence. A rational and deliberative intelligence would weigh coolly and dispassionately the relative advantages of larger long-range benefits or smaller immediate gains. A man whose self-love was passionate and impulsive might seize the gains of the moment and sacrifice the gains of the future. But a man whose self-love was cool, deliberative, and rational, would be guided by his intelligence rather than his impulses, and would prefer the long-range gains even if he had to give up the short-range profits. He would thus be acting in such a manner as to produce consequences which are morally good, even though he may be motivated exclusively by selfishness.

From this point of view, the answer to Shaw's charge that doctors are no more honorable than other people is to point out that they do not have to be, provided that they are more intelligent. There are, of course, individual exceptions—Shaw's irate cynicism indicates that he has had personal experience with unscrupulous doctors—but on the whole, the majority of doctors are sufficiently intelligent to act in accordance with their elevated moral rules. Whether they do so because they

are impelled by a sense of unselfish moral obligation, or a calculated cool self-love, or an enlightened self-interest, their actions can well be equally benevolent. Cool self-love enables them to bring them the maximum of happiness distributed over the course of their whole lives; enlightened self-interest enables them to calculate the consequences of their actions in such a way as to provide a maximum of happiness for themselves through those actions which help others, and thus produce the greatest happiness for the greatest number of people. In either case, even if we grant Shaw's implied premise, that the basic principle of human nature is an irresistible selfishness, it is still possible to transmute this selfishness through the alchemy of intelligence into a socially benevolent principle. All we have to do is to convince the selfish person that the long-range rewards of benevolent action outweigh the short-term gains of immoral conduct. The professions are in essence those vocations which have learned this relatively simple lesson.

For those who find the cynicism of the position of psychological hedonism to be somewhat offensive, as well as for those who advocate it with enthusiasm, it might well be instructive to examine this doctrine in somewhat more detail. I do not myself subscribe to this view, but it is one which is widely held in our present culture, and thus merits careful consideration.

The plausibility of the doctrine that men are so constituted that they can desire only their own pleasures is very well demonstrated by C. E. M. Joad, a contemporary British philosopher. In his book, "A Guide to the Philosophy of Morals and Politics" (Random House, 1938) Joad, who, like myself, is not a hedonist, uses two fascinating examples—*the small girl, and the martyr*—as illustrations of hedonistic argumentation. The actions of both the small girl and the martyr are based on apparently unselfish motives, but a hedonistic analysis discloses that this is not necessarily the case.

In Joad's first example, we are to suppose that two children, a little boy and a little girl, are each presented with five shillings at Christmas. Tommy, aiming only at his own immediate pleasure, spends his five shillings on sweets, gorges them, and is sick. His grandparents scold him for his selfishness and lecture to him about gluttony. Jane, however, spends her money on presents for her grandparents, who duly praise her for her unselfishness. At its face value, Jane seems to have acted in such a way as to put the pleasure of other people before her own, thereby refuting the doctrine of hedonism. Not at all, the hedonist would say. This is false on three counts. (a) Jane is a calculating and intelligent little girl. She knows that her grandparents are much richer than she is, and she reasons that if she ingratiates herself with her grandparents,

and puts them under an obligation to reward her, she is likely to obtain more benefits in the long run than from the direct expenditure of the money on herself. (b) Besides, little girls are priggish, they enjoy the satisfaction of feeling virtuous, and Jane knows that the contrast between her action and her brother's will heighten the approbation with which her grandparents will view her conduct. Her action, therefore, merely proves that she prefers the pleasures of social approval to those of eating candy. (c) But if this explanation seems too cynical, let us grant instead that Jane is really by nature unselfish and benevolent. This means that she sincerely enjoys giving pleasure to others. It could well be that Jane, being an unselfish little girl, gets more pleasure from gratifying her wish to give pleasure to others than she could get from gratifying her own more obvious bodily appetites. Thus the giving of pleasure to others is her most direct form of gratification. It is evident, therefore, that since Jane is by nature unselfish, she can obtain her greatest pleasure by performing an unselfish act; and that when she does perform a truly unselfish act, since it is aimed at obtaining for herself her own greatest pleasure, she is really acting selfishly.

Joad's second illustration is that of the martyr who goes to the stake for his opinions. Certainly he does not seem at first sight to be aiming at his own greatest pleasure. But, as Joad points out,

"appearances are deceptive. To begin with, most martyrs have been men endowed with a strong histrionic sense, and have accordingly derived the greatest possible pleasure from occupying the center of the stage. Now a martyr is at least assured of the limelight, even if the limelight is hot as well as bright."

Again, says Joad, martyrs are men of iron determination, or pig-headed obstinacy, and like all self-willed men, they like getting their own way so much that they insist on it even at the cost of the pain of being burnt. But more important, adds Joad, is the consideration that martyrs have been men of strong religious convictions who believed in eternal damnation for those who prove false to their beliefs. Consequently, Joad points out,

"the choice, as it appeared to them, was a choice between being roasted for fifteen minutes in an earthly fire and being roasted for eternity in an infernal one."

To choose the former was therefore merely common prudence. Or again, to put the matter less cynically,

"the martyr, a steadfast and conscientious man, suffers more from betraying his most cherished convictions than from the pain of the fire; so at least he thinks, for it is in the nature of such men to rate spiritual pain as more grievous than bodily."

Therefore, in choosing the stake, he is aiming at his own greatest pleasure, or its equivalent, the avoidance of his own greatest pain. A similar analysis, adds Joad, may be applied to any other case of apparently self-denying or self-sacrificing conduct.

The doctrine which denies the possibility of disinterested action

has always had a wide acceptance. It has a superficial plausibility, and it has always been popular with those who wanted to rationalize their own selfishness and with decent people who wanted to be taken for men of the world and were embarrassed at being virtuous. As C. D. Broad points out in his book "Five Types of Ethical Theory," as a psychological theory the doctrine was killed by Bishop Butler, but it still flourishes among bookmakers and "smart young business men whose claim to know the world is based on an intimate acquaintance with the shady side of it." Butler, according to Broad, "killed the theory so thoroughly that he sometimes seems to the modern reader to be flogging dead horses. Still," Broad continues, "all good fallacies go to America when they die, and rise again as the latest discoveries of the local professors. So it will always be useful to have Butler's refutation at hand."

Butler's fundamental doctrine is that the human mind is so organized that we can distinguish in it different propensities and principles. However, it is not enough to list them without describing the manner in which they are related to each other. His favorite example is that it is not enough to point out that a watch consists of a spring, wheels, hands, etc., without explaining the mechanical relationships between the parts—that the spring makes the wheels turn, that the balance wheel controls them, and that the purpose of the watch is to tell time.

Butler compares the nature of man to both a watch and a constitutional government. There is no principle of wrong-doing in man, or anything in him that is intrinsically evil. In a manner reminiscent of Plato, Butler holds that wrong-doing is always the excessive or inappropriate functioning of some principle of action which is right when acting in its due degree and in its proper place. It is like a watch with a spring which is too strong for its balance wheel, or a government in which one of the main divisions usurps the functions of another. Man is a complex whole of various propensities arranged in a hierarchy. The actual relative strength of these propensities may not be the same as the relative strength which they ought to have. The latter is their moral authority. Sometimes a principle of higher moral authority may be psychologically weaker than a lower one. The rightness or wrongness of an action, or even an intention, can be judged only by viewing it in relation to the whole system. Thus we judge an act differently if it is performed by a child or a lunatic than if it is done by an adult in his right mind.

Butler thus agrees that no one can act except in accordance with his own nature, that whatever a man does is natural. On this view virtue consists in acting in accordance with the ideal nature of man, and vice consists in acting against it.

Butler distinguishes four springs of action, or different kinds of propensities in a man. These are (1) *particular passions or affections*, (2) the general principle of *cool self-love*, (3) the general principle of *benevolence*, and (4) the supreme principle of *conscience*.

1. The *particular passions or affections* are impulses to or aversions from particular kinds of objects, such as hunger, sexual desire, anger, envy, sympathy, etc. Some of these mainly benefit the agent, and others mainly benefit other people, but they cannot be reduced to self-love or benevolence, because they desire a particular or immediate object, rather than the maximum happiness of the agent or of society.

2. *Cool self-love* is the tendency to seek the maximum happiness for ourselves over the whole course of our lives. It is essentially a rational calculating principle which leads us to check and co-ordinate particular impulses so as to produce the greatest happiness for us in the long run.

3. The general principle of *benevolence* is also a rational calculating principle, which makes us try to maximize the general happiness according to a rational and impersonal scheme rather than as prompted by impulsive sympathy. Our formalized charitable institutions and organizations such as orphanages and clinics exhibit very much this kind of benevolence.

4. The principle of *conscience* is supreme over all the rest in authority. Ideally, it determines how far cool self-love and benevolence are to be carried, and in turn these determine how far the particular impulses or passions are to be gratified. In a particular case, self-love may overpower conscience and spread itself at the expense of benevolence thus producing the coolly selfish man. Or benevolence may overpower conscience at the expense of self-love, or proper prudence, and produce a man who neglects all reasonable care for his health and happiness to work for the general welfare.

Particular impulses may overpower self-love, or benevolence, or both, e.g., *revenge* or *impulsive sympathy* may lead to actions inconsistent with both self-love and benevolence. Self-love is continually overcome by particular impulses like pride, envy, anger, etc., with disastrous results to the happiness of the individual and the welfare of society. Self-love alone is not an adequate principle of action. But as far as it goes, it is rational and produces consequences which are very much the same as those produced by benevolence. According to Butler, the actions which are most disastrous to others are usually such that no person who was aiming at his own maximum happiness would dream of performing them, because in the long run they destroy the agent.

Butler's sermons were written over two hundred years ago, in 1726, but if they had been written today for American optometry, they

could not have been more pointed as the answer to commercial optometry and the inspiration for professional optometry. If the young man who sells his license to practice optometry to a commercial operator were to take into account the damage that he is doing not only to society but to his own chances for achieving the maximum amount of happiness in his life, he would shudder at his own stupidity. What he is lacking is not so much *benevolence* as self-love, that is, the cool self-love which would protect him from the impulse to gratify his needs of the moment without a reasonably prudent concern for his own future.

The supreme principle for Butler, as for many high-minded men, is conscience (p. 76). According to Butler, conscience has two aspects, a purely *cognitive* and an *authoritative*. In its cognitive aspect it reflects on the actions, characters and intentions of men. This it does from the point of view of their rightness or wrongness, as determined by the ideal nature of the agent himself—whether a mature man, a child, or a lunatic. What is right for each of them is known to conscience by intuition—which is able to directly apprehend the nature of the good.

The authoritative aspect of conscience consists of the fact that the pronouncements of conscience have supreme authority over every other aspect of human motivation. If benevolence and self-love conflict with conscience, it is they and never conscience which ought to give way. Even when conscience lacks the psychological power to rule the agent, we recognize its *moral* right to be supreme. Of course, not every action needs to be judged by conscience. 99 times out of 100, the particular impulses are organized by benevolence and self-love, in a habitual and automatic fashion, and only in the relatively rare case of conflict or perplexity do we need to turn to conscience for the solution of a moral problem.

There are, of course, certain weaknesses in Butler's position. In one place he says that no action is consistent with human nature if it violates either reasonable self-love or conscience. In another he says that we can justify no course of action which will be contrary to our happiness, since there is no real conflict between conscience and an enlightened self-love.

Furthermore, while in some passages he holds all virtues and vices can be traced to benevolence or its lack, and that nothing can be of any consequence to man but happiness, in another context he points out that we are so made that our consciences approve justice and truth-telling, and goodness: and these, as we all know, sometimes conflict with happiness.

Butler leaves unsolved other important problems, such as whether or not there is any common feature peculiar to right actions, and how

we can tell which is right when the same conscience at different times, or the consciences of different people, issue conflicting directives.

For answers to these questions we have to turn to men like Kant and Mill, whose distinctive solutions of these and other fundamental problems of ethics constitute landmarks in the history of western civilization, but the consideration of their teachings will be deferred for a subsequent paper.

In the meantime, the writings of Butler afford a clear and provocative introduction to the fundamental principles and problems of general ethics, as well as to teaching us the proper role of cool self-love, benevolence, and conscience as springs of human action. I shall close this paper with a brief fragment, in his own inimitable words, from one of Bishop Butler's sermons, written in 1726:

> "The inquiries which have been made by men of leisure, after some general rule, the conformity to, or disagreement from which, should denominate our actions good or evil, are in many respects of great service. Yet let any plain honest man, before he engages in any course of action, ask himself: Is this I am going about right, or is it wrong? Is it good, or is it evil? I do not in the least doubt, but that this question would be answered agreeable to truth and virtue, by almost any fair man in almost any circumstance." (*Sermons*, Vol. II, Sermon 3 on Human Nature, p. 70.)

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CHICAGO, ILLINOIS

ANNOUNCEMENT

OPTOMETRIC EXTENSION PROGRAM CONGRESS DATES

The Optometric Extension Program has announced the time and place of six Regional Optometric Educational Congresses that have been scheduled for the remainder of this year. The list follows:

North Central Congress at Minneapolis. October 2, 3 and 4, in Hotel Leamington.

Middle-Atlantic Congress at Pittsburgh. October 9, 10 and 11, in Hotel Roosevelt.

Northeast Congress at Boston. October 16, 17, 18, in Hotel Kenmore.

All States Congress at Elmira, New York. October 23, 24 and 25, in Hotel Mark Twain.

Heart of America Congress at Kansas City, Missouri. November 27, 28 and 29 in Hotel President.

Northwest Congress at Portland, Oregon. December 11, 12 and 13, in Hotel Multnomah.

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JOIN US DURING ACADEMY WEEK AT CHICAGO IN DECEMBER

The 35th annual meeting of the American Academy of Optometry will be held in Chicago, December 10 - 13, 1955, at The Drake Hotel. The convention will follow the three day series of Academy Post-Graduate Courses announced in August, and again reviewed in this issue, pages 499 - 506.

As usual, the time of the Academy convention will be devoted almost entirely to the presentation of original papers by members and invited guests and to the clinical discussion periods of the five Academy Sections.

Dr. J. Donald Kratz, member of the faculty of the Pennsylvania State College of Optometry, is chairman of the Papers and Program Committee that is now putting the finishing touches to the four day

program. Reports from Dr. Kratz indicate that this meeting will more than equal those splendid programs held at Academy conventions in recent years. The names of those who will present papers and their topics will be announced in a coming issue.

The Section meetings, which are held concurrently each morning from 9:00 A.M. to 11:00 A.M., are also being arranged. The Section chairmen are preparing important programs dealing with the essentially clinical aspects of optometric work. The Academy Sections are, the *Section on Aniseikonia*, Dr. Oscar L. McCulloch, Holyoke, Massachusetts, chairman; *Section on Contact Lens Fitting*, Dr. Bernard Mazow, Houston, chairman; *Section on Occupational Optometry*, Dr. Herman Sager, Lake Success, New York, chairman; *Section on Orthoptics*, Dr. Paul L. Connolly, Detroit, chairman, and the *Section on Pathology*, Dr. Monroe J. Hirsch, Ojai, California, chairman.

At these Section meetings papers dealing with current clinical problems are read and special discussion periods are arranged. These Section meetings are open to all Academy members and guests and are planned to afford those interested in a particular subject an opportunity to hear and discuss with like-minded specialists the newest and latest techniques in each of these fields of optometric practice. These Section meetings have in the past proven themselves to be of great value and advance reports from the Section Chairmen and their Committees indicate the 1955 meetings will be of considerable interest to all optometrists.

This is the time to start planning your Academy week in Chicago for next December. The post-graduate courses are too outstanding and comprehensive to miss and the regular Academy sessions which follow are acknowledged everywhere to be the leading optometric educational event of the year. You owe it to yourself and your patients to attend these meetings. You will return to your office inspired by the sessions you have attended and by the lectures and papers you have heard. You will meet hundreds of the foremost optometric practitioners and educators and you will find these important Academy meetings will enable you to start the coming new year with renewed confidence in yourself and your profession.

Also plan to bring your wife with you to Chicago, December 7 - 13. She will enjoy the shops and theatres while you are attending the Academy sessions. At this same time invite your optometric associates and friends to come with you. Members may sponsor guests to all Academy sessions and these will be most welcome. All members of the profession are invited to the post-graduate courses and registration for these courses is now underway.

The Place is Chicago, Illinois. The Hotel is The Drake. The

Dates are December 7 - 13, 1955. The first three days are given over entirely to the Post-Graduate courses. There are 40 of these comprising 104 hours of class room instruction. The final period will be devoted to the Annual Meeting of the Academy. Four full days of papers, discussion periods and Section meetings. Plan now, to spend a week with us at Chicago in December.

CAREL C. KOCH

CURRENT COMMENTS

Terry Judith Parkins
Editorial Assistant

Optometrists will confer a favor by sending news items of general interest for this department; such as relate to new instruments, clinical techniques, education, visual health and optometric legislation and organization.

MORGAN HONORED BY BRITISH CHAPTER AT CONGRESS

One of the highlights of the International Optical Congress at Dublin, Ireland, was a reception by the British Chapter of the American Academy of Optometry. This was held in the Shelbourne Hotel on Wednesday, July 13. Dr. and Mrs. Meredith W. Morgan, Jr., and their daughter Linda of Berkeley, California, were guests of honor at the reception. Mr. A. E. Turville, Northampton, England, president, and Mr. Eric Batemen, Looe, Cornwall, England, secretary, and other members of the British Chapter are to be commended for the recognition which they achieved for the Academy in honoring its immediate past-president, Dr. Morgan.

Photograph taken at the reception for the Morgans by Staff Photographer of the IRISH TIMES and published with their permission. From left to right, Mr. Bateman, Dr. Morgan and Dr. Fry.

Other Americans attending the reception were Dr. J. Kelly Robinson and his wife, Dr. Evelyn Robinson, Sylacauga, Alabama, and Dr. and Mrs. Glenn A. Fry, Columbus, Ohio. The U. S. Army Medical Service Corps was represented at the Congress by optometrists Lt. Alden N. Haffner and Lt. Arthur Rosen. During the four day Congress period Dr. Morgan presented a paper on "The Relationship between Accommodation and Convergence."

On July 6, in London, Dr. Glenn A. Fry, director, School of Optometry, the Ohio State University, Columbus, presented the Foundation Lecture of the British Optical Association. His paper was, "Blur of the Retinal Image," which has now been published in the July, 1955, issue of the BRITISH JOURNAL OF PHYSIOLOGICAL OPTICS, pages 130-152.

NEWS BRIEFS

The Univis Lens Company, Dayton, Ohio, announces that they have purchased the Bay State Optical Company plant at Westbury, L. I., New York, and will operate it as the Univis Lens Company Frame Division. . . . Dr. Loren L. Pace, Carey, Ohio, was the $1,000.00 winner of the Titmus Optical Company contest for a name for their lens series. The winning name is *Normalsite*. . . . Bausch and Lomb announces that it has now made the six millionth Balrim frame. . . . The current series of B. V. I. ads in mass media carry a real punch. This advertising program by the Better Vision Institute, directed at the public, is doing much to awaken an interest in visual care. The 1955 series of ads is the best ever. . . . Parts of the American Optical Company plant in Southbridge were flooded on August 19 but were rapidly brought into production again. . . . Shuron Optical Company has brought out a new Ronartte Custon Service that enables various combinations of frames to be assembled at the fitting table, and also encourages the patient to have partial frame changes from time to time. . . . Dr. Richard Feinberg, vice-president and dean of the Illinois College of Optometry has been named a member of the educational committee of the Illuminating Engineering Society. . . . The first A.O.A. Four Star Forum of the 1955-1956 season will be held in San Francisco, October 1-2, at the Palace Hotel. Dr. Norman B. Hays, president of the A.O.A. will preside. The speakers will be Dr. Lois B. Bing, Cleveland; Dr. Don A. Frantz, DeKalb, Illinois and Dr. Harold Haynes, College of Optometry, Pacific University. . . . Dr. Paul Boeder, director of the American Optical Company Bureau of Visual Science has been elected president of the Retina Foundation of Boston. . . . Dr. Henry A. Knoll, formerly dean of the Los Angeles College of Optometry, has accepted a position of research and teaching in the department of biophysics at the University of California at Los Angeles.

TRANSACTIONS OF THE
AMERICAN ACADEMY OF OPTOMETRY

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy.

AMERICAN ACADEMY OF OPTOMETRY POST-GRADUATE COURSES

Drake Hotel - December 7, 8, 9, 1955, Chicago

V. J. Ellerbrock, Chairman
Committee on Instruction

D. G. Hummel, Chairman
Committee on Administration

GENERAL INFORMATION ON POST-GRADUATE COURSES

Time: All courses are scheduled for the three days immediately preceding the regular annual meeting of the Academy.

Place: All of the courses will be taught in the Drake Hotel unless otherwise designated.

Applicants: Any optometrist may apply for one or more courses; however, members of the Academy have preference until October 15, 1955.

Cancellation: In case of cancellation the fee will be returned, providing such cancellation is received no later than November 19, 1955.

Cost: The cost per hour of instruction is $2.00 unless otherwise specified.

Enrollment: For most of the courses the enrollment is limited to 30. Several very specialized courses, however, are limited to ten participants.

Number of Courses: Forty (40).

Hours of Instruction: One hundred and four (104).

Applications: All applications should be sent to Dr. D. G. Hummel, 418 The National City Bank Building, Cleveland, Ohio.

Deposit: One-half the total fee for each course must accompany the application. The balance must be paid at the commencement of the courses.

Tickets: Without exception, everyone enrolled in a course must register and pick up the appropriate ticket. Without it, no one can be admitted.

Lecture Rooms: These will be posted at the registration desk. The hotel bulletin board will state the location of the registration desk.

KEY TO DESIGNATION OF PERIODS

Time	Wednesday	Thursday	Friday
8:00 A.M.	W-8	T-8	F-8
9:00	W-9	T-9	F-9
10:00	W-10	T-10	F-10
11:00	W-11	T-11	F-11
12:00	W-12	T-12	F-12
1:00 P.M.	W-1	T-1	F-1
2:00	W-2	T-2	F-2
3:00	W-3	T-3	F-3
4:00	W-4	T-4	F-4
5:00	W-5	T-5	F-5
7:30	W-E	T-E	F-E

Course 1
Legal Aspects of Optometry
Morton L. Abram, Ll.B., D.O.S.
Chicago, Ill.
A two-hour course—$4.00
Periods: W-9, W-10.

The legal development of optometry will be traced in accordance with a comprehensive outline. The legal basis for regulation of optometry will be covered, defined and distinguished from the legal regulation of optometric functions. Case method will be followed, i.e., actual cases will be used to illustrate legal aspects of optometry. Also to be covered will be malpractice and the functions of the expert witness in court.

Course 2
Raubitscheck Arrow Test for Astigmatism
Merrill J. Allen, O.D., Ph.D.
Bloomington, Ind.
A one-hour course—$2.00
Period: T-9.

Some of the tests for astigmatism will be reviewed and evaluated. In comparison, the Raubitscheck test will be described and its advantages will be discussed. There will be practical demonstrations of the Raubitscheck test technique.

Course 3
Amblyopia, Suppression and Related Phenomena
Neal J. Bailey, O.D., Ph.D.
Bloomington, Ind.
A two-hour course—$4.00
Periods: T-10, F-10.

A central problem in the diagnosis and prognosis of cases presenting anomalies of binocular integration is the existence of suppression. The relationship of suppression to amblyopia and other anomalies will be discussed from the point of view of etiology and from this the principles of treatment of such cases will be developed.

Course 4
Problems of Anisometropia
Robert E. Bannon, O.D.
Southbridge, Mass.
A one-hour course—$2.00
Period: W-1.

The spectacle correction of anisometropia is a frequent source of difficulty since it may introduce undesirable prismatic effects, difference in image size, and anomalous binocular space perception. The course will review axial and dioptric anisometropia; prismatic effects; anisophoria; aniseikonia and space perception; prescribing of prisms, iseikonic lenses, and compromise corrections.

Course 5
Presbyopic Additions—Physiological Basis
Robert E. Bannon, O.D.
Southbridge, Mass.
A one-hour course—$2.00
Period: T-1.

This course will review the various ocular factors and how they may be measured in routine clinical practice. Consideration will be given to the determination of near point prescriptions based upon these data and the patient's individual needs.

Course 6
Oblique Astigmatism
Robert E. Bannon, O.D.
Southbridge, Mass.
A one-hour course—$2.00
Period: F-1.

Data on the frequency of oblique astigmatism will be presented and the role of oblique astigmatism upon binocular spatial localization will be discussed. Typical case records and suggestions for prescribing will be offered. Consideration also will be given to certain clues by which spatial localization difficulties may be detected.

Course 7
Design of Eikonic Lenses
Edwin W. Bechtold, O.D.
New York, N. Y.
A four-hour course—$8.00

Periods: T-9, T-10, F-9, F-10.

Translation of eikonometer findings into a final prescription and the design of correction lenses will be developed at length. The procedure for designing single and bi-toric lenses also will be outlined. Special emphasis will be given designs of lenses that can be fabricated by local laboratories.

Course 8
Visual Screening of School Children
Lois B. Bing, O.D.
Cleveland, Ohio
A two-hour course—$4.00
Periods: F-11, F-12.

Problems involved in visual screening of school children will be considered; present screening procedures will be analyzed; currently available screening instruments will be discussed and criteria for referral established.

Course 9
Visual Efficiency and Industrial Performance
C. S. Bridgman, O.D., Ph.D.
Madison, Wisconsin
A two-hour course—$4.00
Periods: W-2, W-3.

The relations between vision and industrial performance and safety will be summarized, along with methods of providing optimum visual environment and visual efficiency.

Course 10
Streak Retinoscopy
Jack C. Copeland, O.D.
Chicago, Ill.
A four-hour course—$16.00
Periods: W-4, W-5, T-4, T-5.

The following outline describes the steps of the presentation:

1. Determination of the neutral point.
2. Detection of low astigmatic errors.
3. Locating the zone of the astigmatic band.
4. Determining the power of the cylinder.
5. Estimating the type and degree of error without lenses.
6. "Guide Angle" technic, in refining axis position.
7. Minus cyclinder procedure.
8. Comparison of streak retinoscopy with standard retinoscopic procedures.

Course 11
Design in Eyewear
Margaret S. Dowaliby, O.D.
Los Angeles, Calif.
A two-hour course—$4.00
Periods: T-2, F-2.

Design of modern eyewear as related to patient's facial features, coloring, etc. Particular attention will be given to the role of eyewear in the feminine wardrobe; wherever possible actual demonstrations will be provided.

Course 12
The Design and Fitting of Contact Lenses
Jack Neill, O.D.
Philadelphia, Pa.
William Feinbloom, O.D., Ph.D.
New York, N. Y.
William Policoff, O.D.
Wilkes-Barre, Pa.
A twelve-hour course—$48.00
Periods: W-9, W-10, W-2, W-3, T-9, T-10, T-2, T-3, F-9, F-10, F-2, F-3.

A comprehensive course in the principles, design, and fitting of modern contact lenses. A considerable part of the course will be devoted to practical problems of fitting.

Course 13
Visual Rehabilitation of the Partially Blind
William Feinbloom, O.D., Ph.D.
New York, N. Y.
A two-hour course—$4.00
Periods: F-4, F-5.

This course will present the role of the optometrist today in the field of rehabilitation. The history, purpose, and present organization of the blind and partially blind agencies in this work will be reviewed.

It now has been amply demonstrated that it is desirable for optometrists to be associated with these agencies. The *modus operandi* for such cooperation will be explained.

The sociological, psychological, and educational problems involved with various optical aids also will be presented.

Course 14
Optics of Contact Lenses
Bernard Rossett, O.D.
New York, N. Y.
Isidore S. Finkelstein, O.D., Ph.D.
New York, N. Y.
A four-hour course—$8.00
Periods: T-4, T-5, F-4, F-5.

The course will cover the following subjects: 1. Contact lenses in isometropia and in anisometropia. 2. Contact lenses in aphakia. 3. Contact lenses in aniseikonia. 4. Contact lenses in subnormal vision and accommodation. 5. Prescription and laboratory computations for contact lenses.

Course 15
Physiological Basis of Discomfort from Glare
Glenn A. Fry, O.D., Ph.D.,
Columbus, Ohio
A one-hour course—$2.00
Period: F-9.

Relative to discomfort from glare, the course includes:

a. Review of basic data.

b. Role of the iris.
c. The role of the optometrist in providing relief.

Course 16
Analysis of Problems with Retinoscopy
Glenn A. Fry, O.D., Ph.D.
Columbus, Ohio
A one-hour course—$2.00
Period: F-3.

The following subjects are covered in this course: Methods of combatting reflections from lens surfaces; interpretation of scissor motion and unusual types of reflexes; interpretation of discrepancies between subjective and retinoscopic findings.

Course 17
Non-glass Ophthalmic Lenses
Robert Graham, O.D.
Pasadena, Calif.
A one-hour course—$2.00
Period: T-1.

Advantages and limitations of modern plastic lenses—where they should and should not be used—and how to utilize them for optimum results.

Course 18
Contact Lenses Currently in Use
Robert Graham, O.D.
Pasadena, Calif.
A one-hour course—$2.00
Period: F-1.

Discussion of 12 significant types of contact lenses currently in use.

Course 19
The Stereoscope as an Orthoptic Instrument
Salvi S. Grupposo, O.D.
Southbridge, Mass.
A one-hour course—$2.00
Period: W-E.

Many modern orthoptic or visual training instruments are essentially elaborations of simple Wheatstone or Brewster stereoscopes. This course will present a review of these stereoscopes with special reference to their optical principles and applications. Practical examples in the design of various types of instruments will be given.

Course 20
Recommended Lighting Levels and Their Measurement
Sylvester K. Guth, E.E., D.O.S.
Cleveland, Ohio
A two-hour course—$4.00
Periods: W-4, W-5.

The course will cover: a. language of lighting: b. lighting recommendations: c. lighting systems; d. lighting surveys.

Course 21
Office Diagnosis of Color Defects
Gordon G. Heath, O.D.
Berkeley, Calif.
A two-hour course—$4.00
Periods: T-8, F-8.

Characteristics of the various types of defective color vision; what the color-blind see; recent advances in clinical methods of testing; simple diagnostic instruments and techniques; remedial measures to aid the color-defective.

Course 22
The Elements of Statistical Reasoning
Monroe J. Hirsch, O.D., Ph.D.
Ojai, California
A four-hour course—$8.00
Periods: W-2, W-3, T-3, F-3.

Another title for this course would be "Statistics Necessary for the Understanding of Scientific Publications" and it is presented from the point of view of the man who has had no formal training in statistics and who feels the need for such a course in order that he may understand papers read at Academy meetings and published in our *Journal*.

The descriptive statistics such as mean, median, standard deviation, and correlation coefficient will be described. The concept of probability will be dealt with more fully, as will the chi square technique.

Course 23
Graphic Analysis of Optometric Findings
Charles Abel, O.D.
Los Angeles, Calif.
Merrill Allen, O.D., Ph.D.
Bloomington, Ind.
H. W. Hofstetter, O.D., Ph.D.
Bloomington, Ind.
A six-hour course—$12.00
Periods: W-4, W-5, T-4, T-5, F-4, F-5.

The art and science of writing an optometric prescription with the aid of the graphic analysis technique. Selected cases will be plotted and analysed both theoretically and practically to the end of writing a prescription for glasses or orthoptics or both. The problem of prism and/or bifocal prescribing will also be covered.

Course 24
Pharmacology Pertaining to the Eye
Isadore Kaplan, M.D.
Philadelphia, Pa.
Periods: T-E, F-E.
A four-hour course—$8.00

The pharmacodynamic action of certain groups of drugs will be described with particular reference to their availability and usefulness in ocular therapeutics.

Course 25
Dark and Light Adaptation
Alfred Lit, O.D., Ph.D.

New York, N. Y.

A two-hour course—$4.00

Periods: T-8, F-8.

The experimental methods and findings on dark and light adaptation will be presented in detail. Special emphasis will be given to the application of these facts in industrial vision, highway safety, human engineering and the clinical detection of ocular pathology.

Course 26
An Introduction to Slit Lamp Microscopy
Bernard Mazow, O.D.

Houston, Texas

A four-hour course—$16.00

Periods: T-11, T-12, F-11, F-12.

Lectures and demonstrations in the mechanics of using the bio-microscope, methods of observation, etc. The participants will practice using the instrument on each other under supervision of the instructor. If time permits, common pathological conditions will be discussed.

Course 27
Physical and Differential Diagnosis in Optometric Practice
David D. Michaels, O.D.

Chicago, Ill.

A four-hour course—$8.00

Periods: W-11, W-12, T-11, T-12.

Recognition of signs and symptoms. Interpretation of history; how to observe the patient for evidence of ocular and systemic disease (constitution, skin, color, edema, etc.). Confirmation for suspected systemic cause of ocular disease; role of optometrist in recognizing general disease apart from the eye.

Course 28
Strabismus Testing and Diagnosis
T. R. Murroughs, O.D.

Evanston, Ill.

A four-hour course—$8.00

Periods: W-11, W-12, T-11, T-12.

A consideration of basic specific tests to evaluate the type of strabismus in terms of the patient's responses. Differential diagnosis established on basis of responses.

Course 29
Distortion of Stereoscopic Spatial Localization
J. F. Neumueller, O.D.

Haddonfield, N. J.

A two-hour course—$4.00

Period: W-E.

Perception of space is distorted by unequal ocular and/or optical, retinal images. Brief survey of magnification properties of ophthalmic lenses—distortion effects demonstrated by means of stereoscopic cards (qualitatively) and simplified computation (quantitatively). Full discussion of 4 main types: Magnification horizontally - vertically - obliquely - asymmetrically (prisms). Application to every day practice stereoscopic cards. Models-lantern slides-synopsis available for each lecture.

Course 30
Introduction to Aniseikonia
J. F. Neumueller, O.D.

Haddonfield, N. J.

A two-hour course—$4.00

Period: F-E.

Historical background-definitions-symptoms. Presentation of the standard eikonometer (targets, test means, adjustments, procedure, sensitivity, limitations) and the space eikonometer (targets, test means, procedure, sensitivity, limitations). Corrective lenses: Over all magnification, meridional magnification, oblique magnification, single vision lenses, bifocals, and bitoric. Translation procedure: F7 translation—fit over lenses—permanent isteikonic lenses. Frequency of occurance, tolerance, and economics in aniseikonia: Lantern slides and synopsis with each lecture.

Course 31
Turville Infinity Balance Test
Henry B. Peters, O.D.

Oakland, California

A two-hour course—$4.00

Periods: T-2, T-3.

Methods and interpretation of monocular refraction under binocular conditions with special emphasis on anisometropia, suppression, lateral and vertical prism, and aniseikonia screening.

Course 32
Aids for the Partially Blind
Wm. W. Policoff, O.D.

Wilkes-Barre, Pa.

A two-hour course—$4.00

Periods: F-1, F-2.

Classification, description and use of subnormal vision aids:

Distance telescopes, near telescopes, contact lenses, magnifiers and microscopes for near, pin hole spectacles, grid spectacles, hemianopsia spectacles, ptosis and entropion retractors, megascope, recumbent spectacles, the Franklin Institute reader and others. The lectures will be fully illustrated.

Course 33
Pitfalls in Industrial Vision
and
Design of Occupational Eyewear
Herman Sager, O.D.

Lake Success, N. Y.

A four-hour course—$8.00

Periods: W-E, T-E.

There are many pitfalls that can be encountered in industrial and occupational vision. These will be reviewed as well as practical ways to circumvent these problems. The course also will include the design and application of the various types of eyewear used in industry for protection of eyes and conservation of vision.

Course 34
Visual Acuity Charts
Carl F. Shepard, O.D.

Chicago, Ill.

A one-hour course—$2.00

Period: W-1.

This will not be a specific discussion of charts but a course in the basic principles which determine the limitations of any test of the ability to see.

Course 35
Scleral and Corneal Tonometry
Harold Simmerman, O.D.

Wenonah, N. J.

Ralph E. Wick, O.D.

Rapid City, South Dakota

A two-hour course—$8.00

Periods: W-1, T-1.

This course is designed to acquaint the practitioner with the two principal methods of measuring intraocular pressure. Each member of the class will have the opportunity of obtaining experience with both methods.

Course 36
Glaucoma
Monroe J. Hirsch, O.D., Ph.D.

Ojai, Calif.

Harold Simmerman, O.D.

Wenonah, N. J.

A two-hour course—$4.00

Periods: T-E, F-E.

The incidence of glaucoma especially in the aged makes it necessary that every optometrist fully understand this complicated visual disorder. To meet this need a specific course on the disorder was organized. It includes the etiology, diagnosis, prognosis and treatment. Special consideration is given to the optometric approach of this disease.

Course 37
Management of the Cataract Patient
Frederick W. Sinn, O.D.

Philadelphia, Pa.

A two-hour course—$4.00

Periods: F-11, F-12.

It is commonly known that many difficulties are encountered in meeting the visual needs of patients with aphakia. These will be reviewed: the roles of vertex distance, tilt of the lenses, center thickness, base curves, etc., also will be discussed.

Course 38
The Fitting of the Microlens
Newton K. Wesley, O.D.

Chicago, Ill.

A two-hour course—$4.00

Periods: W-11, W-12.

An advanced course: it will include the history and development of microlenses, basic principles of the lenses, uses, limitations, patient interview, objective factors, subjective factors, and psychological factors. Demonstration of actual patients also will be provided.

Course 39
Geriatrics and Optometry
Ralph E. Wick, O.D.

Rapid City, S. D.

A two-hour course—$4.00

Periods: W-9, W-10.

Geriatrics is defined as the care of the aging and the aged. A brief introduction will be given to the field of geriatrics together with a review of visual changes associated with age. An attempt will then be made to apply the principles of geriatrics to the practice of optometry.

Course 40
Fixation Disparity as a Diagnostic Method
Daniel Woolf, O.D., Ph.D.

New York, N. Y.

A two-hour course—$4.00

Periods: T-8, F-8.

A basic course in the clinical measurement of fixation disparity at near in a refractor; the basis and technique of the test, and interpretation of results with patient discomfort in mind. Actual demonstrations for each participant will be provided.

A Condensed Schedule of all Courses will be found on the following page, and an Order Form for use in enrolling in the Courses will be found on page 506.

The Following Are Condensed Schedules of Courses Previously Described

Course	Instructor	Subject	Periods
1	Abrams	Legal Aspects of Optometry	W-9 W-10
2	Allen	Raubitscheck Arrow Test for Astigmatism	T-9
3	Bailey	Amblyopia, Suppression and Related Phenomena	T-10 F-10
4	Bannon	Problems of Anisometropia	W-1
5	Bannon	Presbyopic Additions - Physiological Basis	T-1
6	Bannon	Oblique Astigmatism	F-1
7	Bechtold	Design of Eikonic Lenses	T-9 T-10 F-9 F-10
8	Bing	Visual Screening of School Children	F-11 F-12
9	Bridgman	Visual Efficiency and Industrial Performance	W-2 W-3
10	Copeland	Streak Retinoscopy	W-4 W-5 T-4 T-5
11	Dowaliby	Design in Eyewear	T-2 F-2
12	Neill Feinbloom Policoff	The Design and Fitting of Contact Lenses	W-9 W-10 W-2 W-3 T-9 T-10 T-2 T-3 F-9 F-10 F-2 F-3
13	Feinbloom	Visual Rehabilitation of the Partially Blind	F-4 F-5
14	Rossett Finkelstein	Optics of Contact Lenses	T-4 T-5 F-4 F-5
15	Fry	Physiological Basis of Discomfort from Glare	F-9
16	Fry	Analysis of Problems with Retinoscopy	F-3
17	Graham	Non-glass Ophthalmic Lenses	T-1
18	Graham	Contact Lenses Currently in Use	F-1
19	Grupposo	The Stereoscope as an Orthoptic Instrument	W-E
20	Guth	Recommended Lighting Levels and Their Measurements	W-4 W-5
21	Heath	Office Diagnosis of Color Defects	T-8 F-8
22	Hirsch	The Elements of Statistical Reasoning	W-2 W-3 T-3 F-3
23	Abel Allen Hofstetter	Graphic Analysis of Optometric Findings	W-4 W-5 T-4 T-5 F-4 F-5
24	Kaplan	Pharmacology Pertaining to the Eye	T-E F-E
25	Lit	Dark and Light Adaptation	T-8 F-8
26	Mazow	An Introduction to Slit Lamp Microscopy	T-11 T-12 F-11 F-12
27	Michaels	Physical and Differential Diagnosis in Optometry Practice	W-11 W-12 T-11 T-12
28	Murroughs	Strabismus Testing and Diagnosis	W-11 W-12 T-11 T-12
29	Neumueller	Distortion of Stereoscopic Spatial Localization	W-E
30	Neumueller	Introduction to Aniseikonia	F-E
31	Peters	Turville Infinity Balance Test	T-2 T-3
32	Policoff	Aids for the Partially Blind	F-1 F-2
33	Sager	Pitfalls in Industrial Vision and Design of Occupational Eyewear	W-E T-E
34	Shepard	Visual Acuity Charts	W-1
35	Simmerman Wick	Scleral and Corneal Tonometry	W-1 T-1
36	Hirsch Simmerman	Glaucoma	T-E F-E
37	Sinn	Management of the Cataract Patient	F-11 F-12
38	Wesley	The Fitting of the Microlens	W-11 W-12
39	Wick	Geriatrics and Optometry	W-9 W-10
40	Woolf	Fixation Disparity as a Diagnostic Method	T-8 F-8

AMERICAN ACADEMY OF OPTOMETRY
Post-Graduate Courses

Applications should be made to Dr. D. G. Hummel, 418 The National City Bank Building, Cleveland 14, Ohio. One-half of the total fee must accompany the application. The balance must be paid at the commencement of the courses. Without exception, everyone enrolled in the courses must register and pick up appropriate tickets for each course. Without them, no one can be admitted. Acceptance of applications will be on a first come first served basis. Academy Fellows will receive preference only until October 15, 1955. When the number allowable in any course is filled, applications will be received on a contingent basis and used in case of cancellation. In case of cancellation the fee will be returned, providing such cancellation is received no later than November 19, 1955.

Advance Order Sheet

Please check the courses you wish to take.

No. of Course	Instructor	Hours	Total Fee	Date	Time

Name _____

Address _____

City _____ State _____

Member of A.A.O. _____ A.O.A. _____ C.A.O. _____ Other _____

For Use of the Committee on Administration

Deposit _____ Balance _____

Date Received _____

Notified _____ Date _____ Accepted _____ Contingent _____

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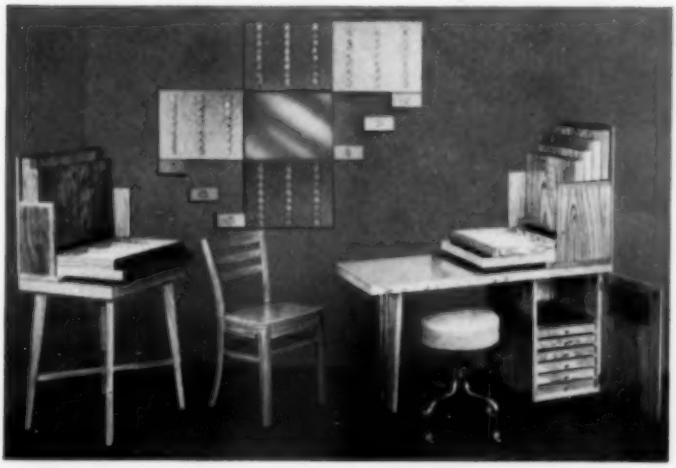

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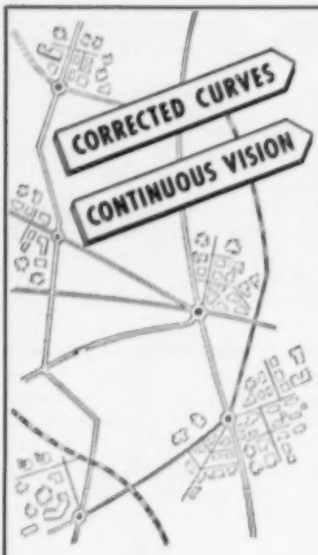

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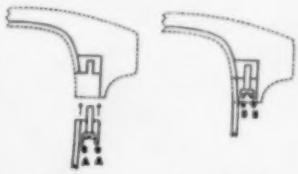

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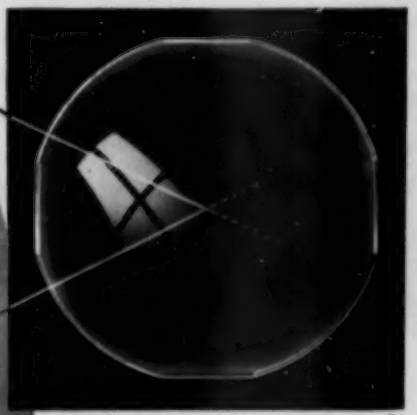

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